

Skylight Camera Site Planning Document

9347-0111 Rev C

Sec 1: General Requirements1-1
Sec 2: Room Layouts2-1
Sec 3: Anchor Details3-1
Sec 4: Networking4-1
Sec 5: Shipping Information5-1
Sec 6: Floor Loading6-1

Warranty Disclaimer

Philips provides this document without warranty of any kind, either implied or expressed, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Limitation Of Liability

Philips has taken care to ensure the accuracy of this document. However, Philips assumes no liability for errors or omissions and reserves the right to make changes without further notice to any products herein to improve reliability, function, or design. Philips may make improvements or changes in the product(s) or program(s) described in this document at any time.

About This Document

This document provides site planning information for customers planning to purchase a Skylight camera and their facility engineers, structural engineers, site planners and architects.

CAD Drawings

Drawings in a DWG format for the Skylight system are downloadable from the following website for architects planning room layouts:

<http://apps1.medical.philips.com/documents>

Copyright Notice

© August 15, 2003 Koninklijke Philips Electronics N.V. All rights reserved.

Section 1

General Requirements

General Information

Figure 1-1 on page 1-3 illustrates the Skylight components described below.

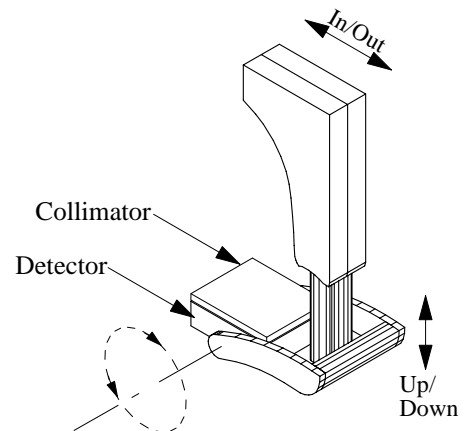
The Skylight system consists of an overhead frame supported by four 4" diameter steel posts.

The system images patients as they lie on a patient table inside the frame.

A carriage translates along the overhead frame and supports two image-collecting detectors.

The detectors can move up and down, in and out, and rotate around their own axis. This allows the detectors to image patients from above, below, or from the sides of a patient.

Prior to imaging a patient, nuclear medicine technologists attach a pair of “collimators” on the detectors. Collimators are 21" x 26" (53cm x 66cm) sheets of lead. Several different types of collimators exist; collimators weigh between 110 and 260 lbs (50 and 118 kg).



When a pair of collimators are not on the detectors, technologists will store the collimators in a floor-mounted, collimator exchanger on one side of the Skylight frame.

The system also includes two “towers” containing electronic components: the PC tower and the power tower.

The PC tower contains image processing and networking equipment.

The power tower contains an uninterruptible power supply (UPS) and other power supplies.

The PC tower, power tower, collimator exchanger and vanity covers fill one side of the Skylight frame.

Clinical Operation

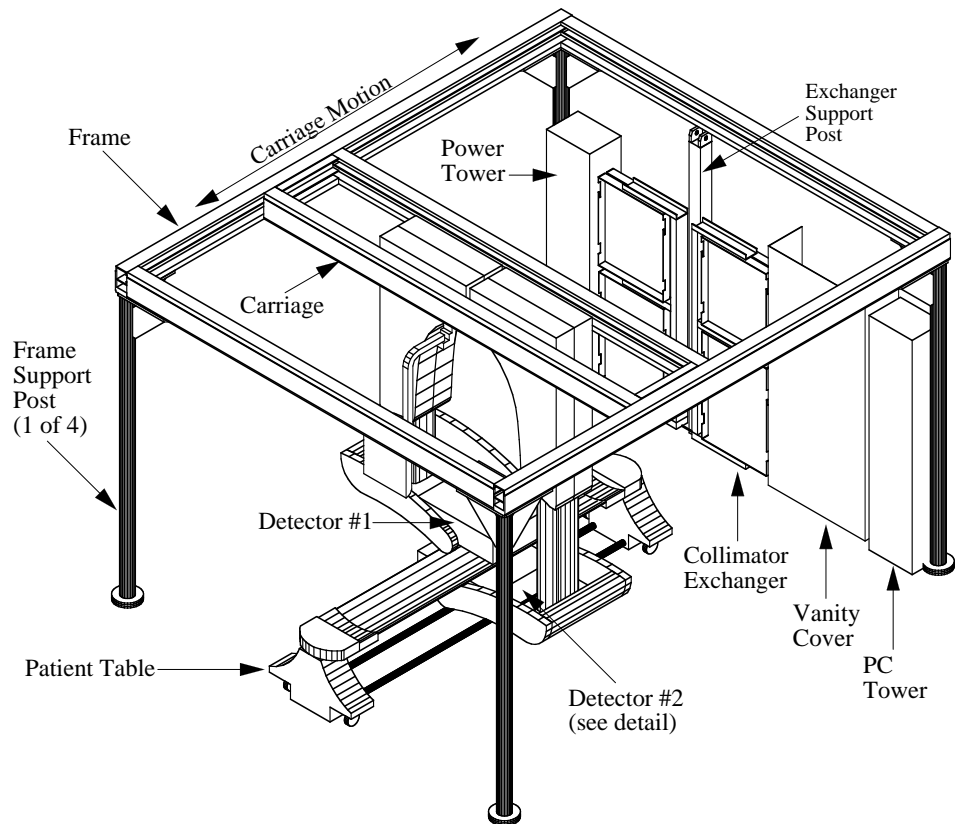
Although not shown in Figure 1-1, a desktop processing station (a PegBlade) must be located outside the frame, but preferably in the same room. From the PegBlade, physicians view and interpret images produced by the system.

Patients to be imaged by the Skylight system receive a small intravenous injection of a gamma-ray-emitting radionuclide. The collimators contain a pattern of gamma-ray admitting holes perpendicular to the imaging surface of the detectors. The detectors sense the radiation that passes through holes in the collimators.

The detectors transmit electronic data to image processors in the PC tower. The image processors produce images for physician interpretation on the PegBlade processing station.

The Skylight system performs these types of clinical studies:

- Emission Computed Tomography (ECT) -- the carriage remains in one position while the detectors rotate around the patient's torso. Image processors produce a set of three dimensional tomographic images. The images show radionuclide concentration in parallel slices of the patient's internal organs.
- Total Body -- the carriage translates along the length of the patient (usually head to toe). One detector scans above the patient table; the other scans below patient table. The image processors produce two images (anterior and posterior) showing radionuclide concentration in the patient's skeleton and other tissue.
- Static (Spot) or Dynamic -- the carriage and detectors remain fixed positions near the patient. The system produces either a single image (static), or a sequence of images (dynamic) showing the flow of radionuclide within the patient over time.



Note:
Covers around front posts and
filling all open spaces above
Power Tower, PC Tower and
Exchanger are not shown.

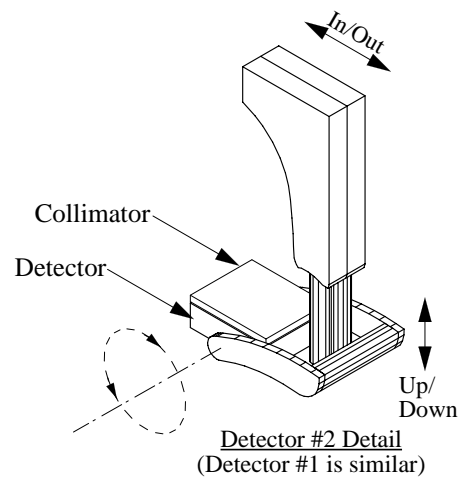


Figure 1-1. Skylight Camera System.

Collimator Exchanger

Technologists store collimators in vertical drawers of the collimator exchanger.

To transfer a collimator from an exchanger drawer to a detector, an operator will swing the drawer 90° into the room, translate the carriage to the exchanger, and move a detector next to a drawer as Figure 1-2 illustrates.

All Skylight systems come with a two-drawer collimator exchanger. That exchanger will hold four pairs of collimators.

Customers may purchase a second, one-drawer collimator exchanger. The one-drawer exchanger will hold two more pairs of collimators. As Figure 1-3 shows, the one-drawer collimator exchanger resides on the same wall as the two-drawer exchanger.

Skylight Models

The Skylight system comes in one of four models:

- a 9 foot Skylight,
- a 9 foot California (seismic) Skylight,
- an 8 foot Skylight,
- an 8 foot California (seismic) Skylight.

The California (seismic) models have thicker-walled steel posts and three top braces above the Skylight frame.

Vibration Specifications

Nuclear medicine cameras do not have floor vibration specifications. This is because:

- image collection durations are long (10 - 300 seconds, or more) and floor vibration durations are much smaller,
- vibrations are typically sinusoidal and, therefore, tend to cancel out, and
- the patient table and detector/gantry assemblies are both floor mounted and tend to vibrate together.

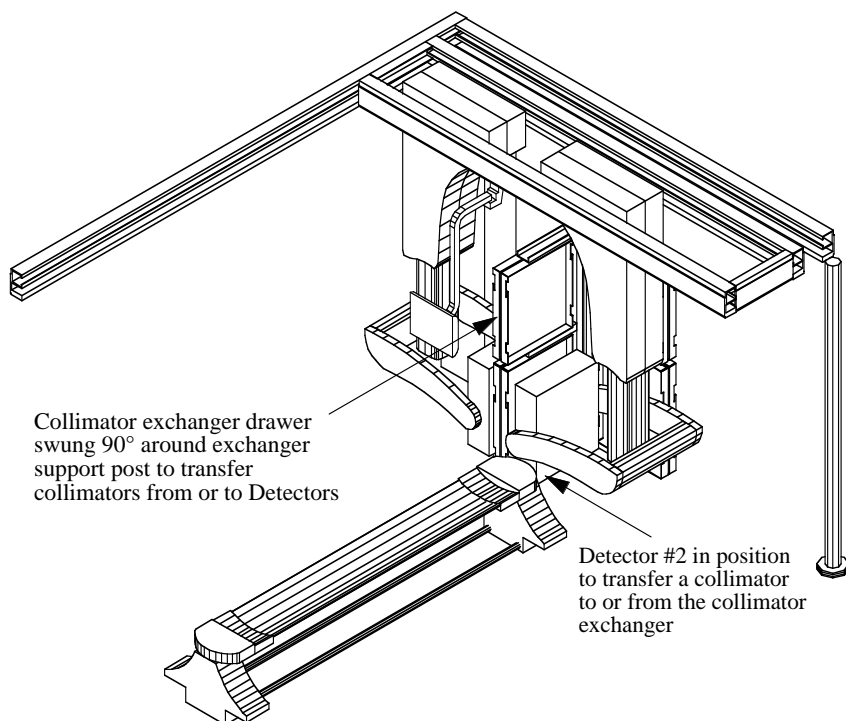


Figure 1-2. Collimator Exchange Operation.

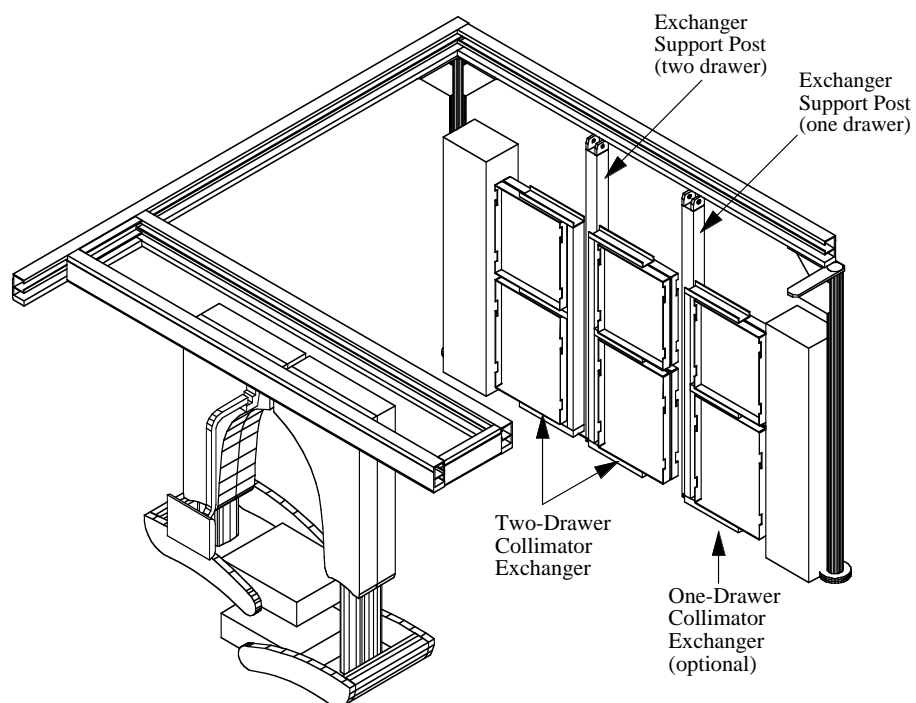


Figure 1-3. One-Drawer and Two-Drawer Collimator Exchangers

Power Requirements

The power requirements for a Skylight camera and PegBlade are as follows:

	<u>Skylight Camera</u>	<u>PegBlade</u>
Input Voltage: (International)	208 - 240 V - dedicated 208 - 240 V - dedicated	120 V 220 V
Peak/Quiescent Current: (International)	15 A / 4.8 A 15 A / 4.8 A	5 A / NA 2.5 A / NA
Phase:	Single Phase	Single Phase
Receptacle:	Hardwired	NEMA 5-15
Note: The Skylight camera includes a UPS and provides power to the detectors, carriage, patient table, towers, acquisition terminal and collimator exchanger. An optional cardiac gate can plug into a 115 volt receptacle on the patient table.		

Air Conditioning Requirements

The system produces these heat loads:

Skylight System	PegBlade	PegBlade Monitor
5,653 BTU/hr	854 BTU/hr	544 BTU/hr
396 Cal/sec	60 Cal/sec	38 Cal/sec
1,656 watts	250 watts	159 watts

The camera room HVAC system must maintain the temperature between 60° - 75° F (16° - 24° C) with less than 10° F (6° C) variation per hour. Humidity must be between 20% - 75%.

These requirements must be met on a 24 hours per day, 7 days per week basis.

Magnetic Field Limitations

To avoid image quality and video monitor problems, the Skylight system must not be in an area with a magnetic field greater than 1 Gauss.

Floor Levelness

The floor under the four Skylight frame posts, the collimator exchanger post(s) and the patient table must all be at the same level $\pm 1"$.

Section 2

Room Layout

Room Size Requirements

	<u>9 Ft Skylight</u>					<u>8 Ft Skylight</u>				
	<u>W</u>	<u>x</u>	<u>D</u>	<u>x</u>	<u>H</u>	<u>W</u>	<u>x</u>	<u>D</u>	<u>x</u>	<u>H</u>
Minimum Size	12'-6"	x	14'	x	9'	12'-6"	x	14'	x	8'
	381cm	x	427cm	x	274cm	381cm	x	427cm	x	244cm
Recommended Size	16'-7"	x	16'-10"	x	9'	16'-7"	x	16'-10"	x	8'
	505cm	x	513cm	x	274cm	505cm	x	513cm	x	244cm

Figure. 2-1 illustrates a minimum room size. In such rooms, the site must provide a separate, nearby room for the PegBlade processing station.

Figures 2-2 and 2-3 illustrates two recommended room sizes. Such rooms facilitate patient access and technologist/physician convenience. To keep frame support posts close to walls, Philips installers can extend one of the frame support posts from 20" to 36" in either the X or Y direction from the normal post position (Figure 2-2 & 2-3).

Equipment Sizes (9 ft and 8 ft Skylights)

	<u>W</u>	<u>x</u>	<u>D</u>	<u>x</u>	<u>H</u>	<u>Wt</u>	
Skylight System ¹	11'-10"	x	13'-6"		see Fig 2-4 & 2-5	see pg 6-3	
	361cm	x	411cm				
Patient Table (minimum height)	2'-5"	x	9'-6"	x	1'-9"	320	lbs
	74cm	x	290cm	x	53	145	kg
PegBlade CPU (placed on customer's desktop)	18"	x	18"	x	5"	27	lb
	46cm	x	46cm	x	13cm	12	kg
PegBlade monitor (placed on customer's desktop)	20"	x	20"	x	20"	69	lb
	51cm	x	51cm	x	51cm	32	kg
Codonics Printer (option) (placed on customer's desktop)	17"	x	21"	x	12"	55	lbs
	43cm	x	53cm	x	30cm	25	kg

Important: Unless the floor is a reinforced concrete slab poured on grade, a licensed structural engineer must evaluate floor loading capacity. See Section 6.

¹ At installation, Philips must lay a 11'-9.3" x 13'-5.4" rectangular metal drill template on the floor (see Section3). There must be no objects at floor level to interfere with this template.

Section 2: Room Layout

Minimum (12'-6" x 14') Room Restrictions:

- Anchor plate for frame support posts placed 1" from wall on side of Two-Drawer Collimator Exchanger (instead of more desirable 3" placement),
- Acquisition Terminal placed outside of room,
- Processing Station placed in separate, nearby room,
- Display Panel and Boom tied in one position (instead of allowing desirable free rotation of boom),
- Doors cannot swing into room.

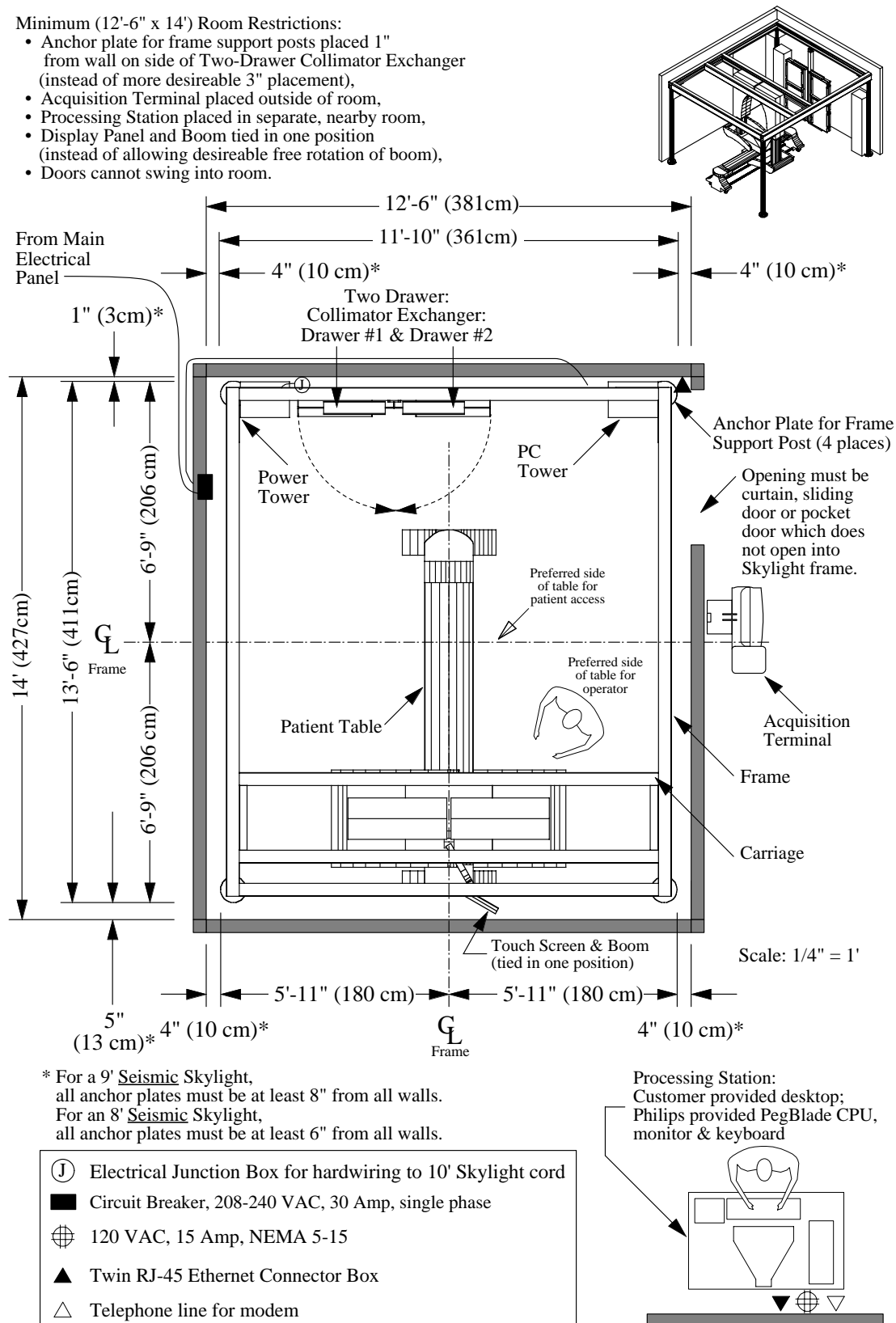
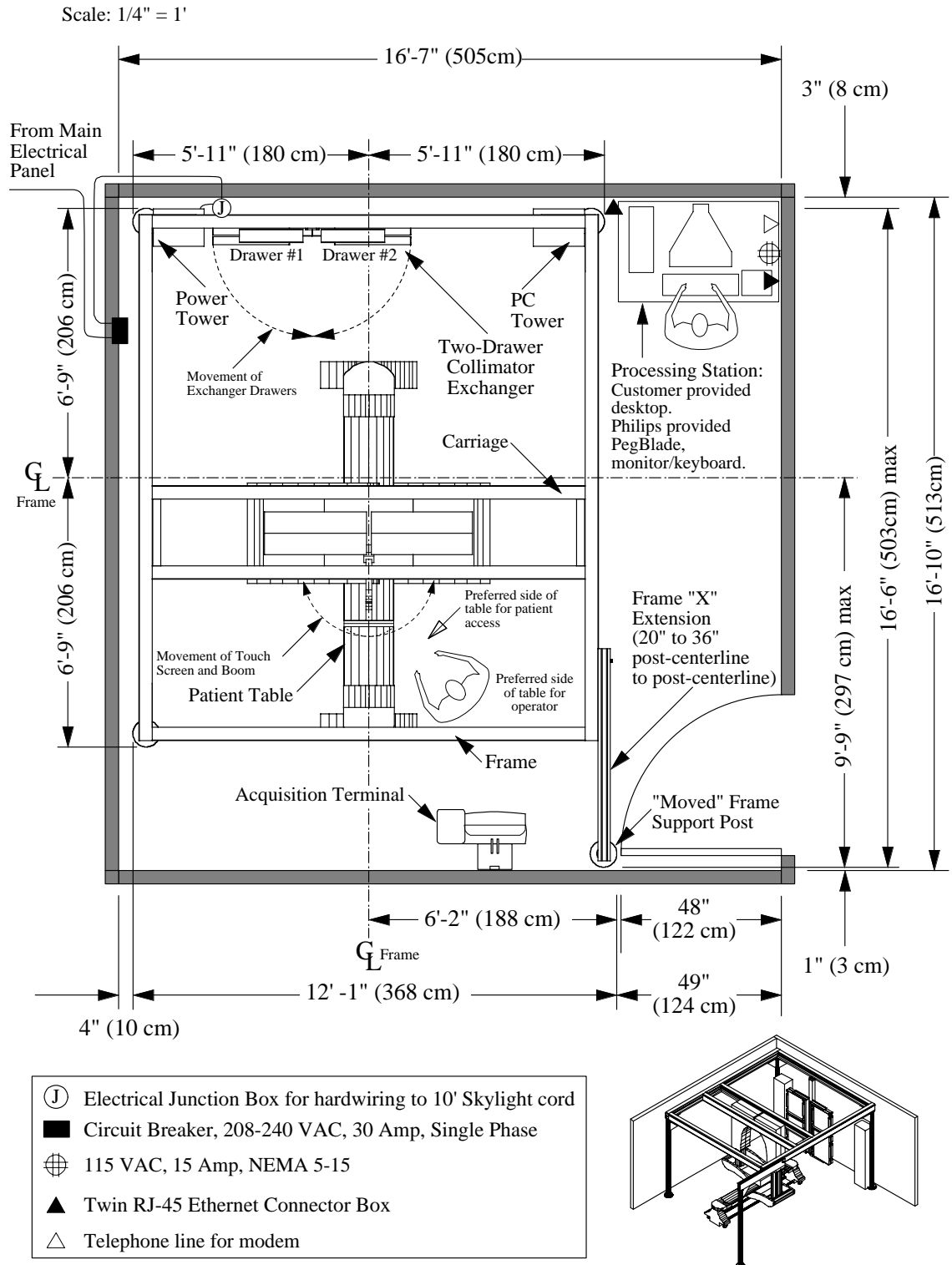


Figure 2-1. Skylight in Minimum Size Room and PegBlade in Separate Room.

Section 2: Room Layout



Section 2: Room Layout

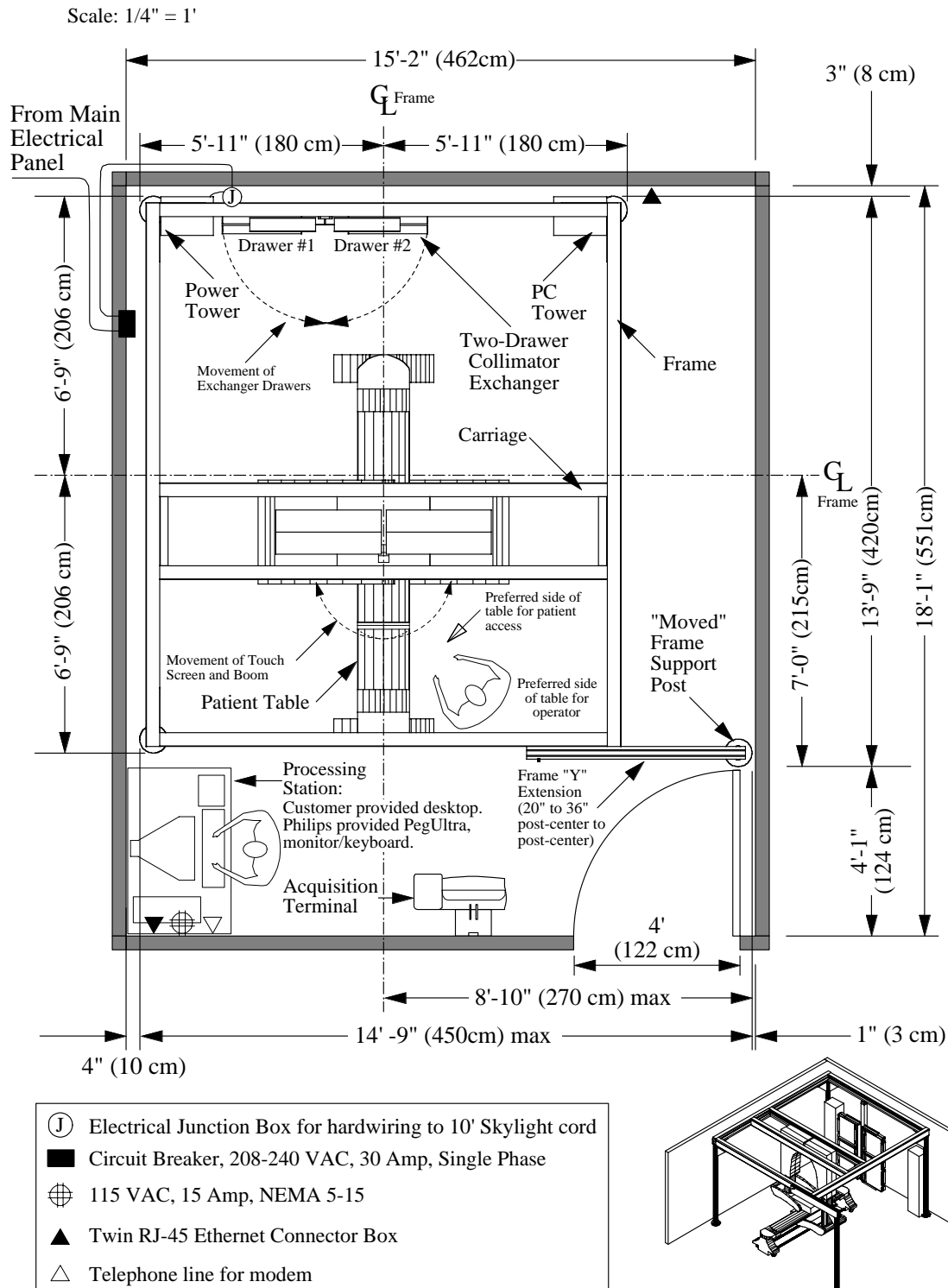
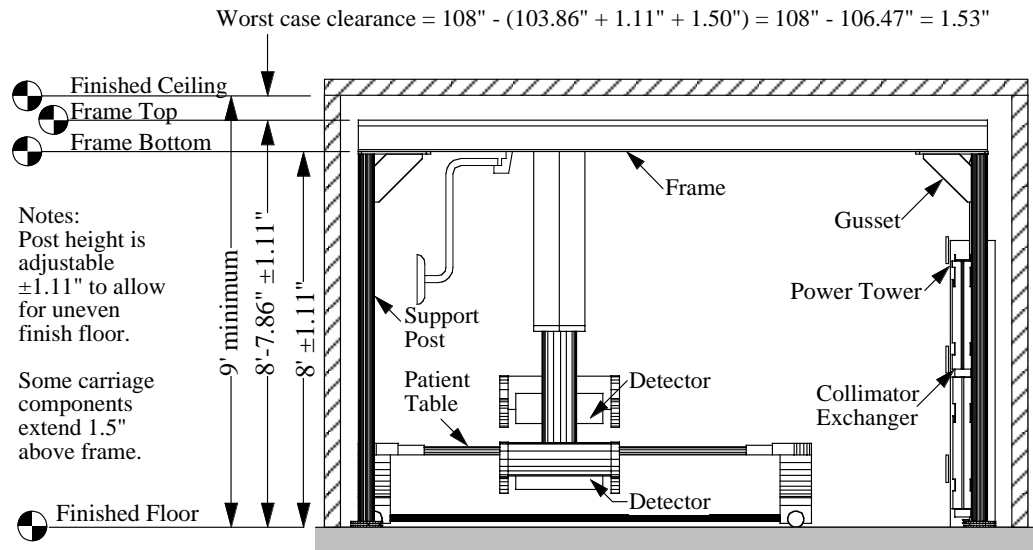
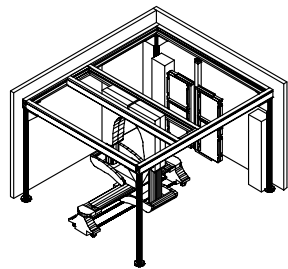


Figure 2-3. Skylight in Recommended Room #2.

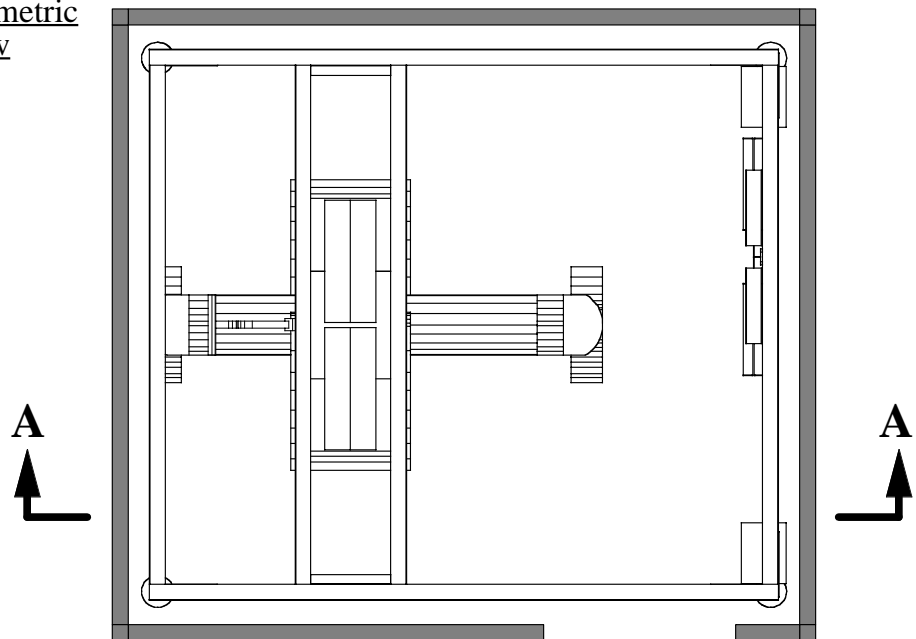


Section AA
Elevation (Side) View



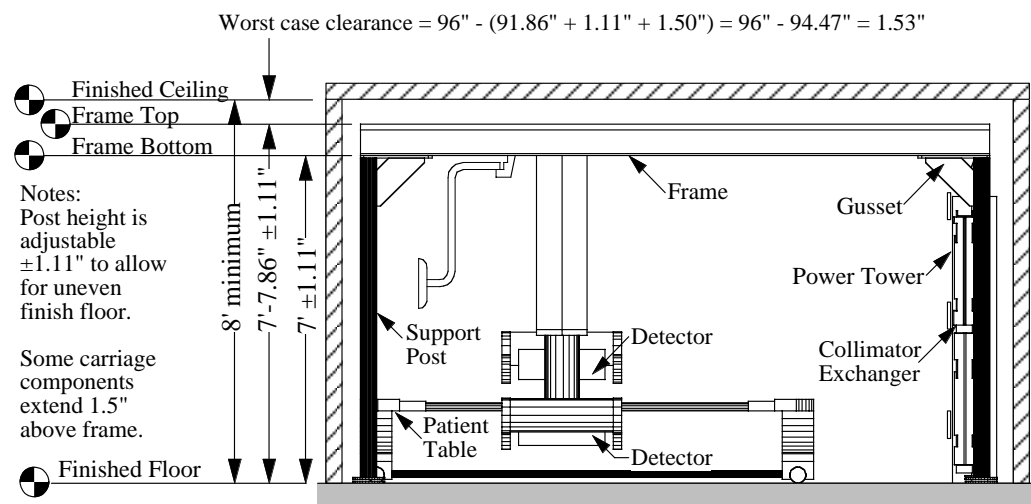
Right Isometric
View

Scale: $1/4" = 1'$



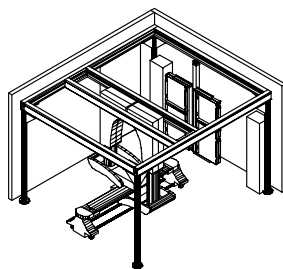
Plan (Top) View

**Figure 2-4. Elevation Details, 9 ft Skylight
(non-California)**

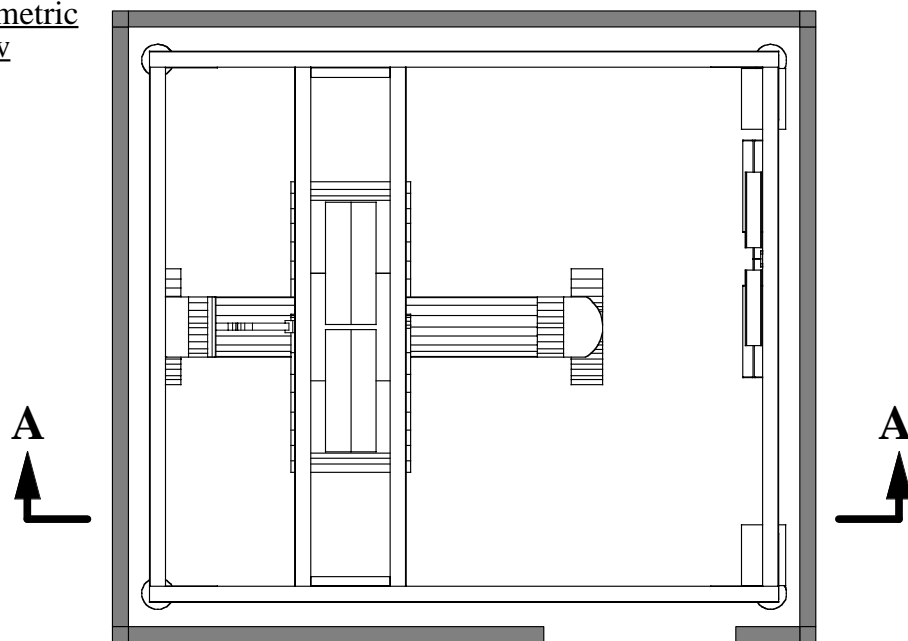


Section AA
Elevation (Side) View

Scale: $1/4" = 1'$



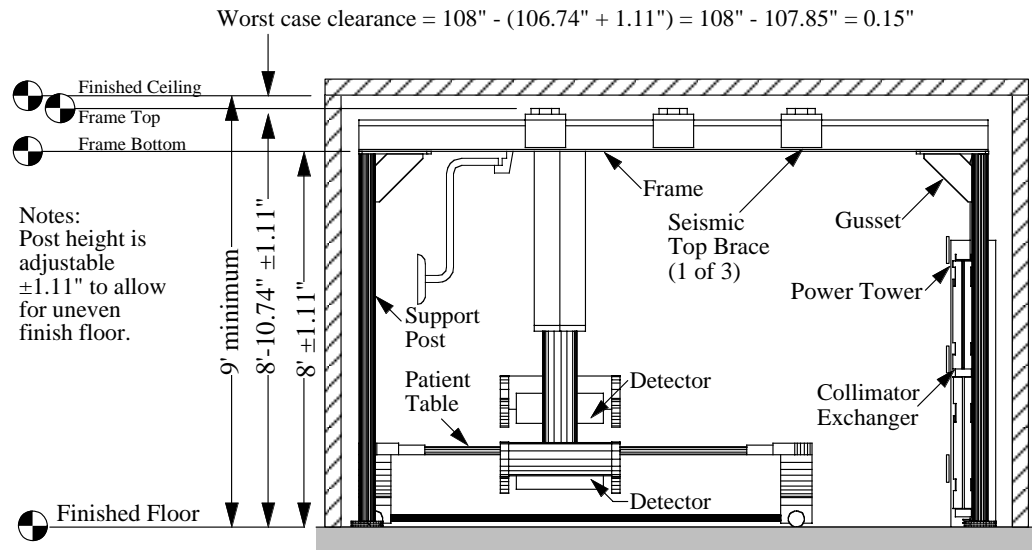
Right Isometric
View



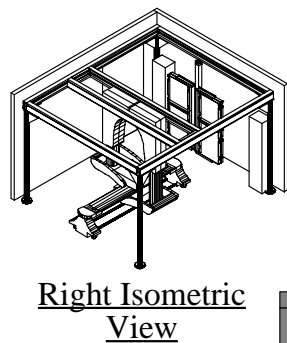
Plan (Top) View

**Figure 2-5. Elevation Details, 8 ft Skylight
(non-California)**

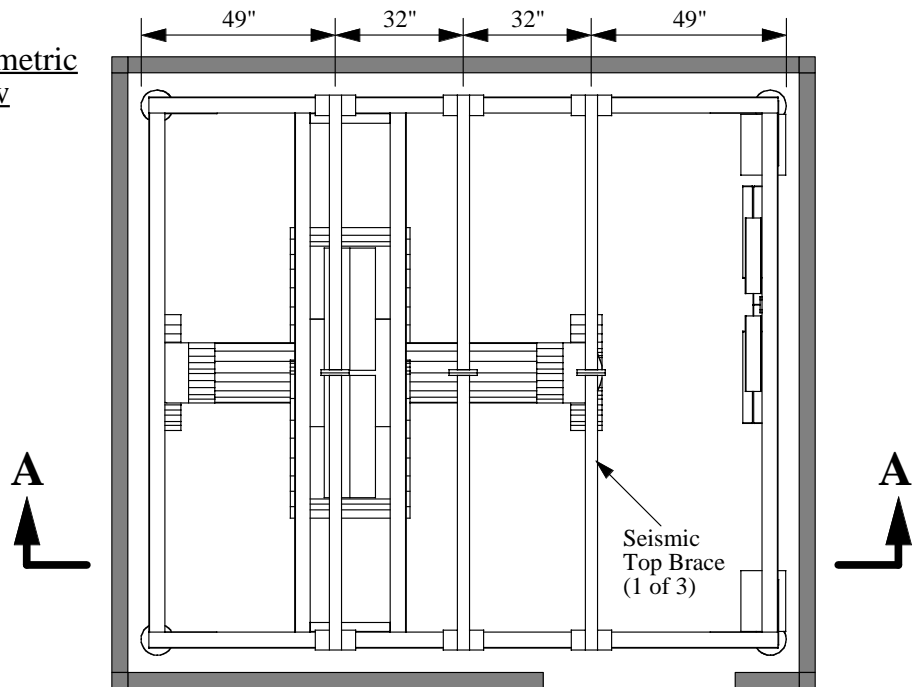
Section 2: Room Layout



Section AA
Elevation (Side) View

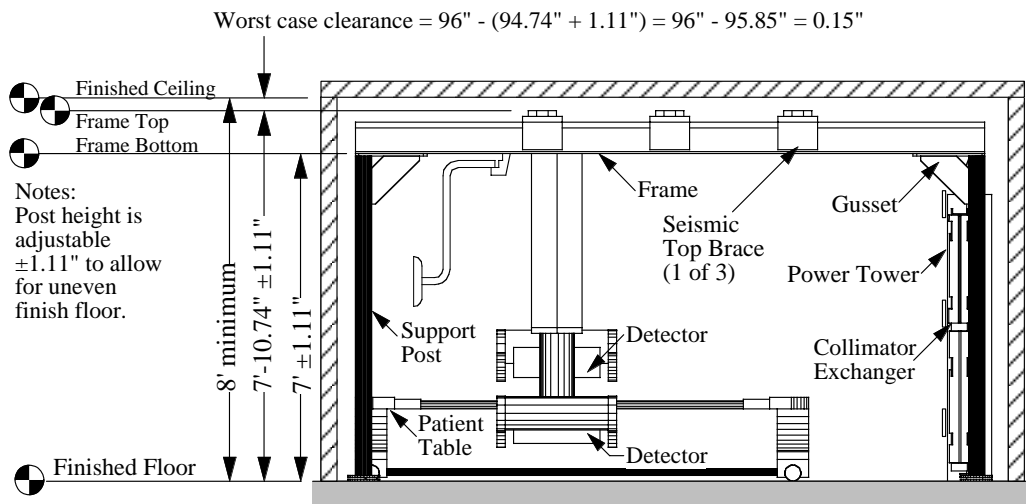


Scale: 1/4" = 1'

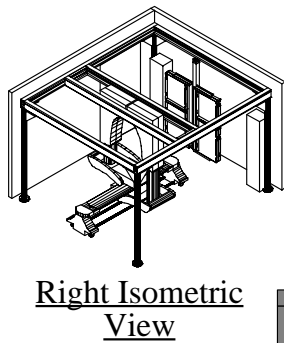


Plan (Top) View

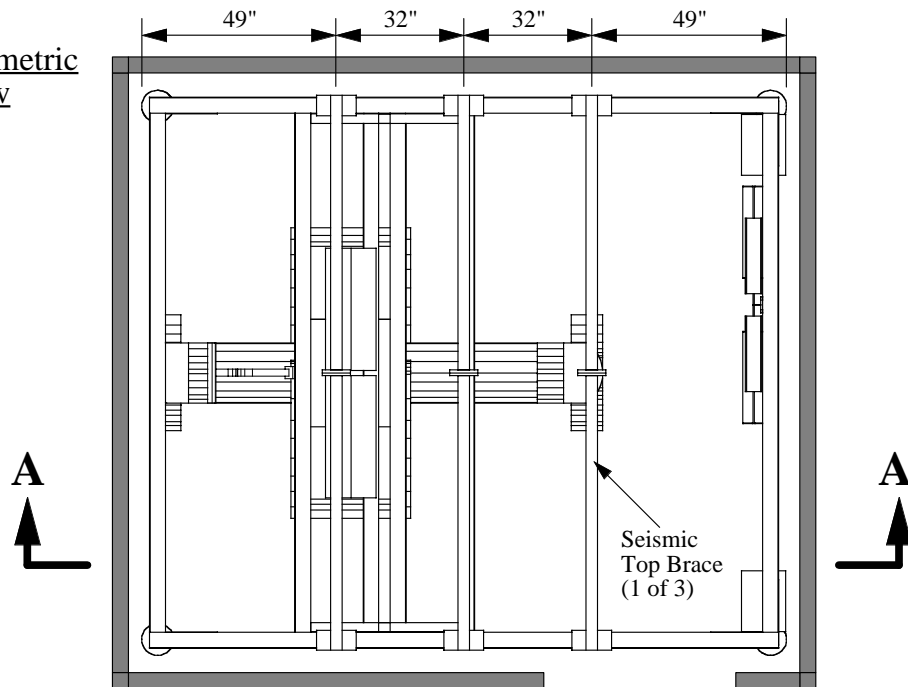
Figure 2-6. Elevation Details, 9 ft Skylight
(California Seismic)



Section AA
Elevation (Side) View



Scale: $1/4'' = 1'$

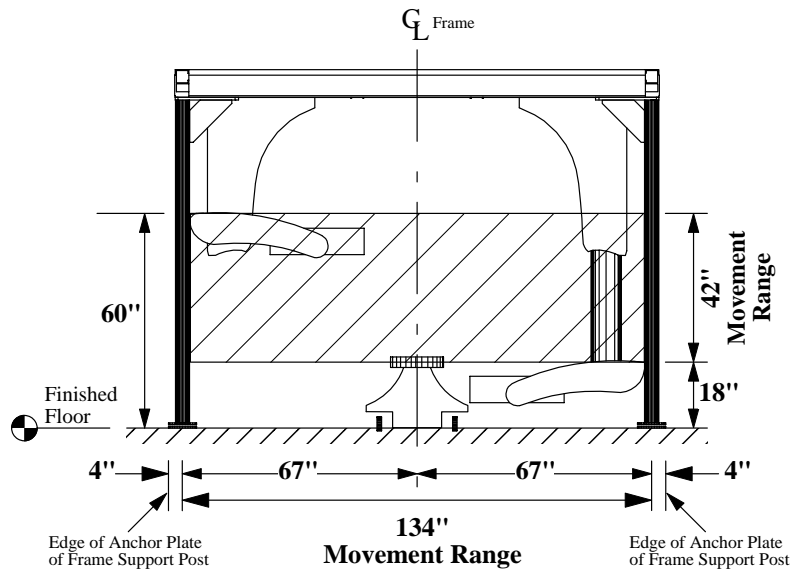
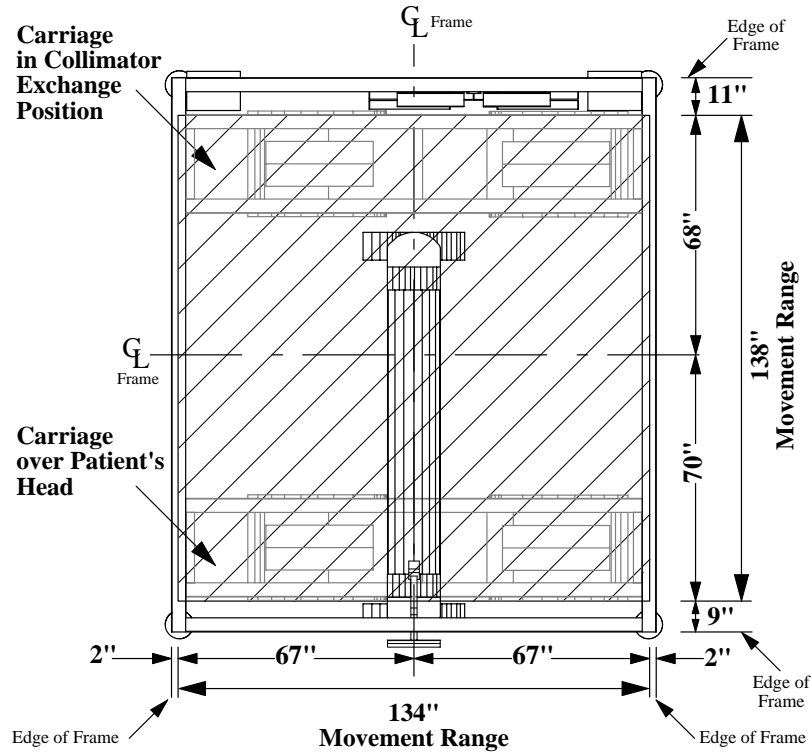


Plan (Top) View

**Figure 2-7. Elevation Details, 8 ft Skylight
(California Seismic)**

Maximum Detector Movement

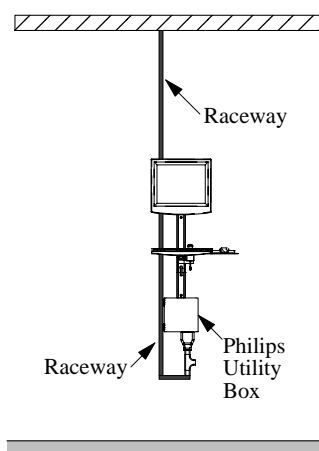
To avoid collisions with the Skylight detector arms, the space in the movement range shown below must be free of all non-Skylight objects (entrance door swings, cabinetry, medical gas fixtures, etc.).



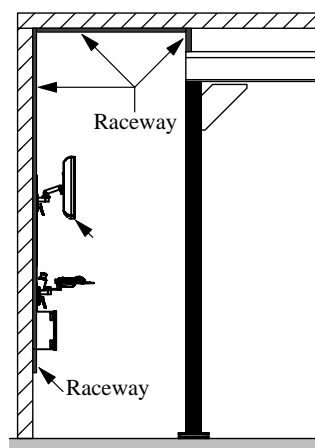
Signal and 110 VAC power cables come from the Skylight PC Tower to an Philips-provided, wall-mounted utility box underneath the Acquisition Terminal. Depending on customer preference, Philips installers will run these cables either in:

- an Philips-installed raceway (preferred), or
- a customer-installed conduit (optional).

Philips-installed Raceway. Philips installers will usually run 1.5" x 1" white raceway from the Acquisition Terminal utility box, vertically up the wall and over to the nearest point on the Skylight frame.



Elevation Front View

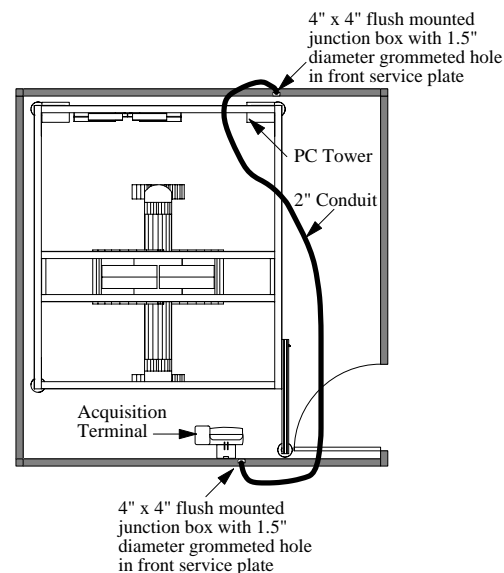


Elevation Side View

Customer-installed Conduit. Customers not wanting raceway must install 2" diameter conduit from a flush-mounted customer junction box 9" above the floor behind the PC Tower to another flush-mounted customer junction box 18" above the floor under the Philips Utility Box beneath the Acquisition Terminal.

The maximum cable length from the PC Tower to the Acquisition Terminal is 70 feet.

Acquisition Terminal Placement. Philips has optimized the Skylight system for the operator to stand on the right side of the patient table (as viewed looking toward the collimator exchanger). Therefore, if possible, it is best to mount the Acquisition Terminal on the right side, or front right side, of the patient table.

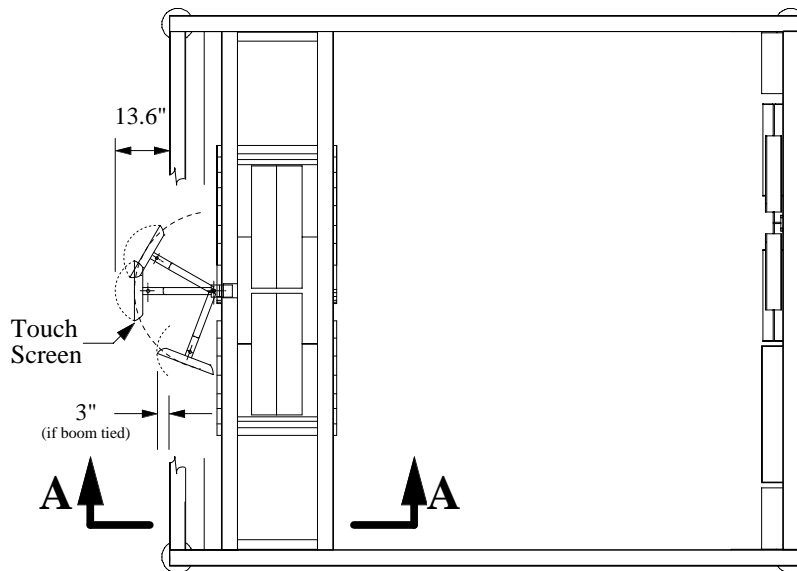


Weight of the Acquisition Terminal. The combined weight of the flat screen monitor and other components of the Acquisition Terminal is about 30 pounds.

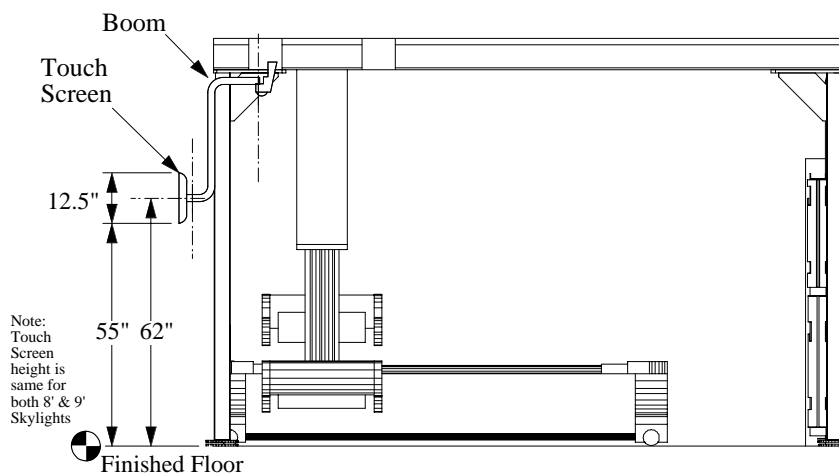
Touch Screen and Boom

The Skylight system includes a boom-mounted Touch Screen from which the operator can control motions and other operations. The boom is mounted on, and moves with, the Carriage.

For operator convenience, the boom is free to rotate about its attachment point on the Carriage. The Touch Screen extends 13.6" beyond the frame when the operator moves the Carriage to the non-Exchanger end of the Skylight frame. If the boom is secured to the Carriage (which is not desirable except in small rooms such as shown in Figure 2-1), the Touch Screen extends 3" from the frame.



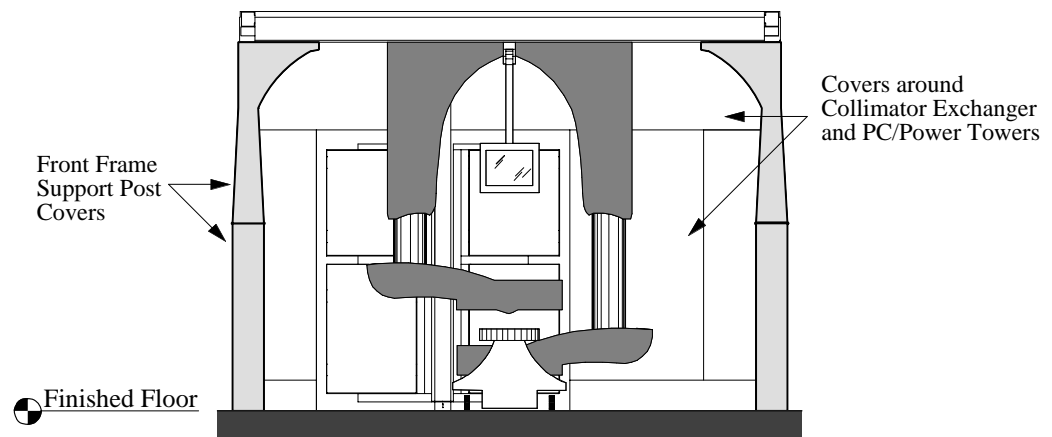
Plan (Top) View



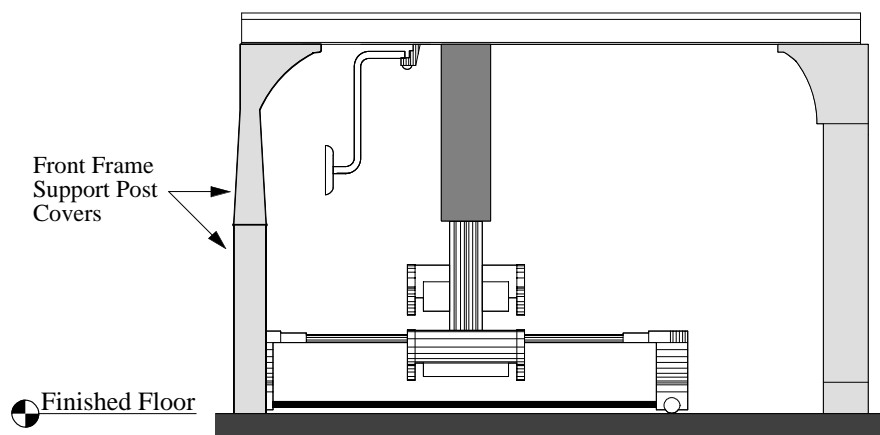
Section AA
Elevation (Side) View

Cosmetic Covers

As a final step during installation, Philips installers will place covers over the front Skylight frame support posts. Installers will also place covers over the open spaces around and above the collimator exchanger and the PC and Power Towers.



Elevation View (Front)



Elevation View (Side)

CAD Drawings

For the use of architects doing room layouts, drawings in a DWG format for the Skylight system are downloadable from the following website:

<http://apps1.medical.philips.com/documents>

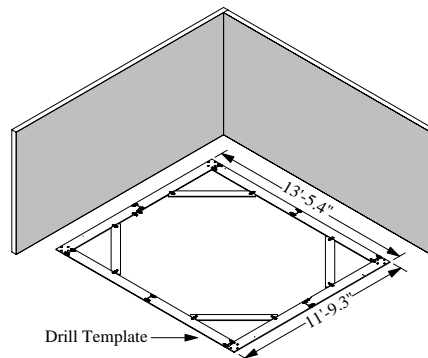
Section 3

Anchor Details

Anchor Plan

Philips installers will locate and drill holes for four 1/2" concrete anchors for each corner post by placing a large metal drill template on the floor.

The figures in this section illustrate the anchor locations for Skylights with no frame extension, X-extensions and Y-extensions. (Section 2 discusses extensions.)



After installing the Skylight posts and frame, Philips installers will attach the two-drawer collimator exchanger post to the frame and anchor it with four 3/8" flush anchors. If the customer orders the optional one-drawer collimator exchanger, installers will install an additional post in a similar manner.

Anchor Specifications

Philips installers will use these types of expansion anchors:

<u>Manufacturer</u>	<u>Model</u>	<u>Diameter</u>	<u>ICBO #</u>	<u>Embedment</u>	<u>Applicable Post</u>
Hilti	Kwik-Bolt II	1/2"	4627	3.50"	Frame Support
Hilti	HDI	3/8"	-	-	Collimator Exchanger

California Seismic Information

Philips is in the process of obtaining "Pre-approval of Anchorage for Fixed Hospital Equipment" for the Skylight system from the State of California Office of Statewide Hospital Planning Department (OSHDP).

When the OSHDP documentation becomes available, customers may obtain a copy from this website:

<http://apps1.medical.philips.com/documents>

Until OSHDP Pre-approval becomes available, Philips will assist customer architects and structural engineers in obtaining site-specific OSHDP approval. To request site-specific calculations call 408/468-3280.

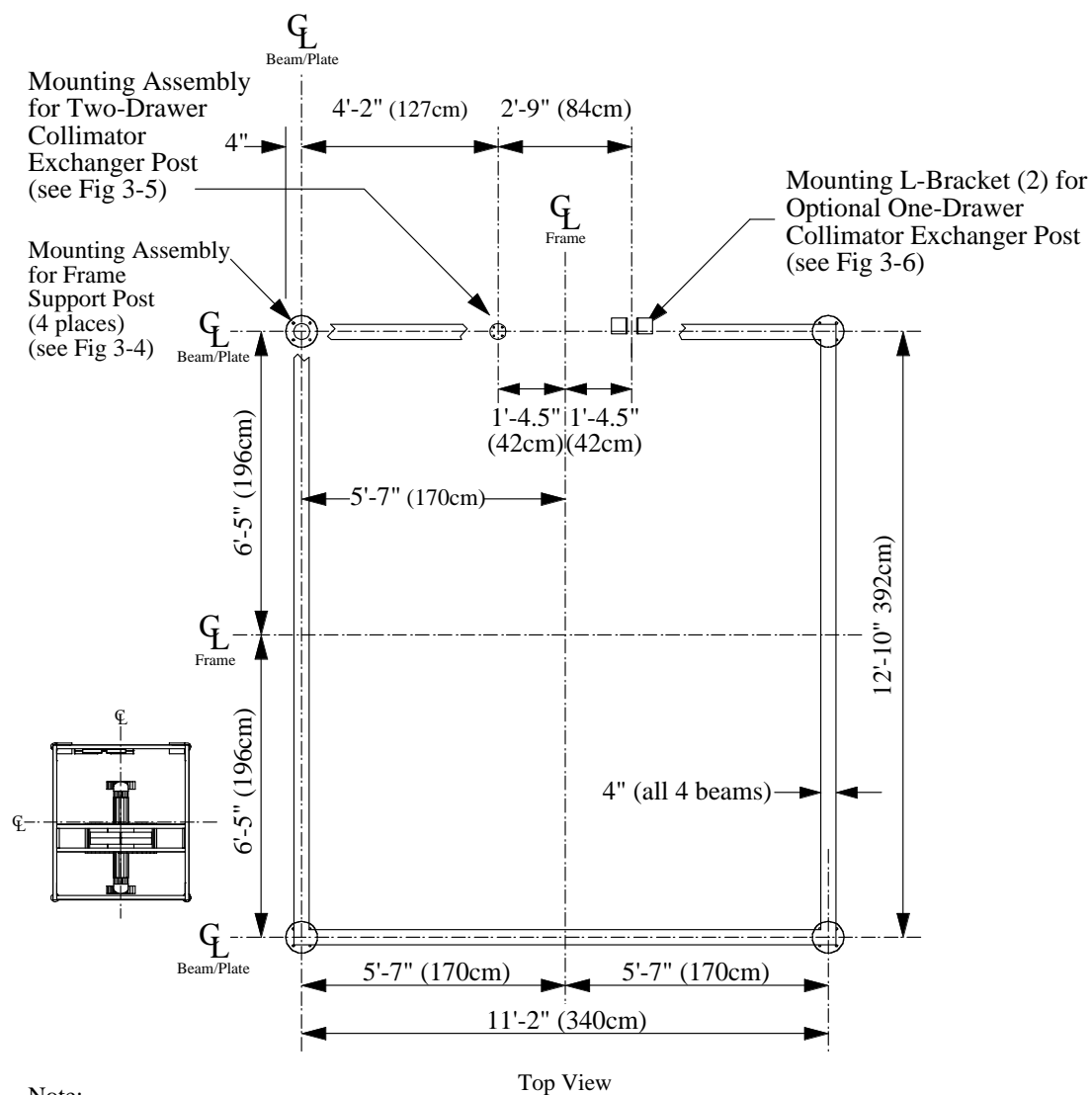


Figure 3-1. Skylight Anchor Plan, No Frame Extension

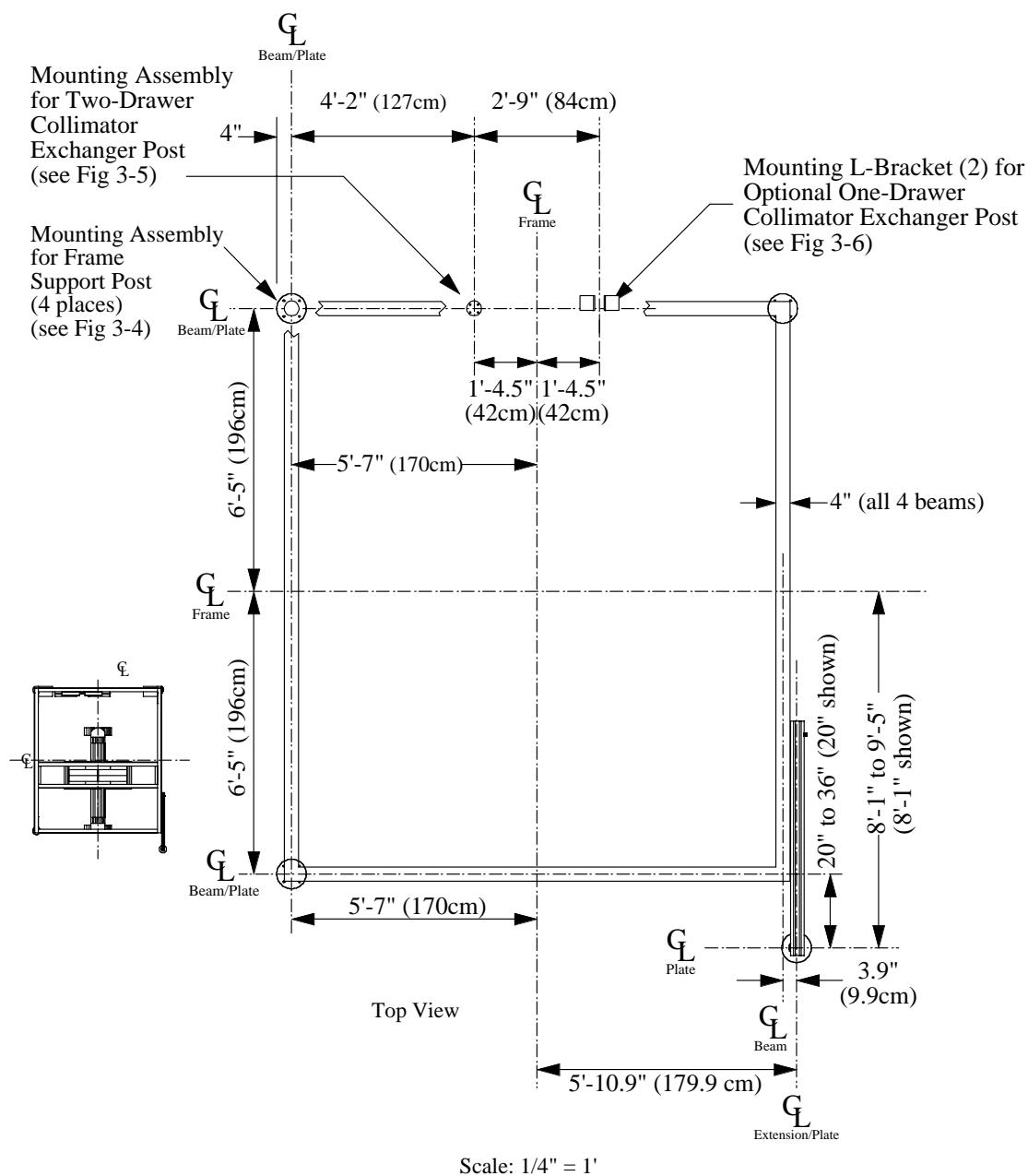
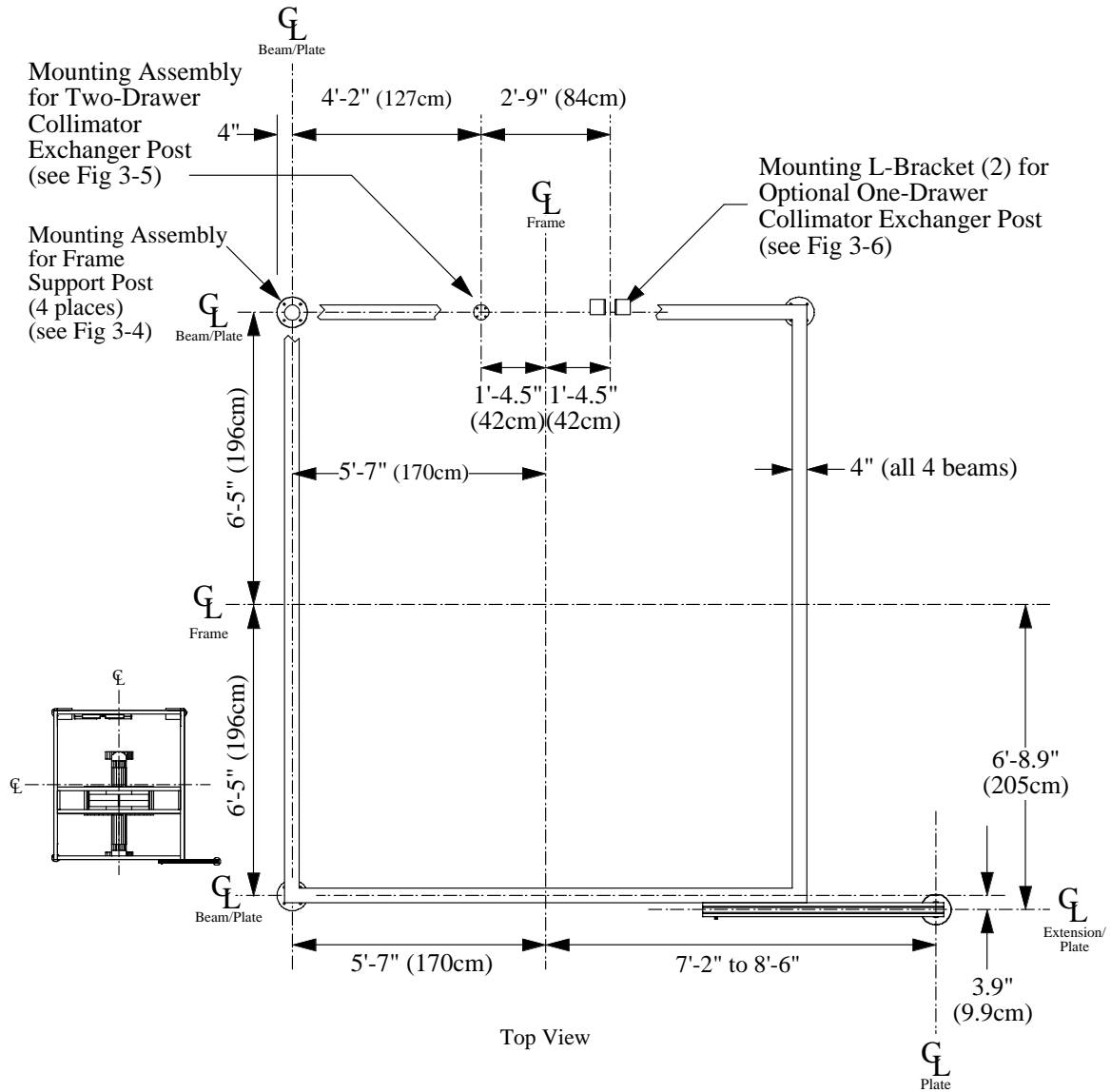


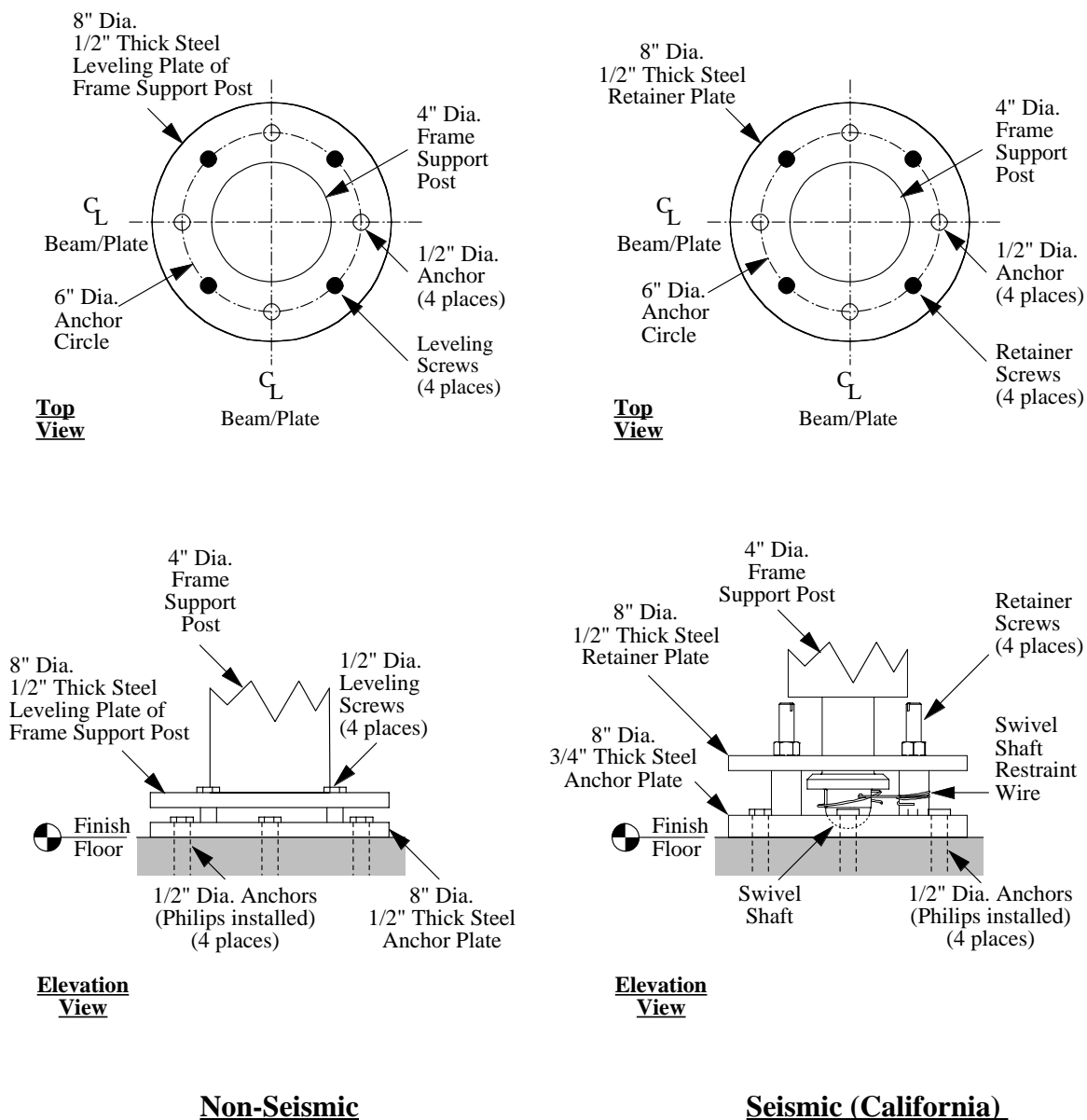
Figure 3-2. Skylight Anchor Plan, X-Extension (long axis)



Note:
 Anchor holes must not be drilled before installation.
 Installers determine exact anchor locations:
 - for Frame Support Posts using a drill template, and
 - for Exchanger Posts after attaching post to frame.

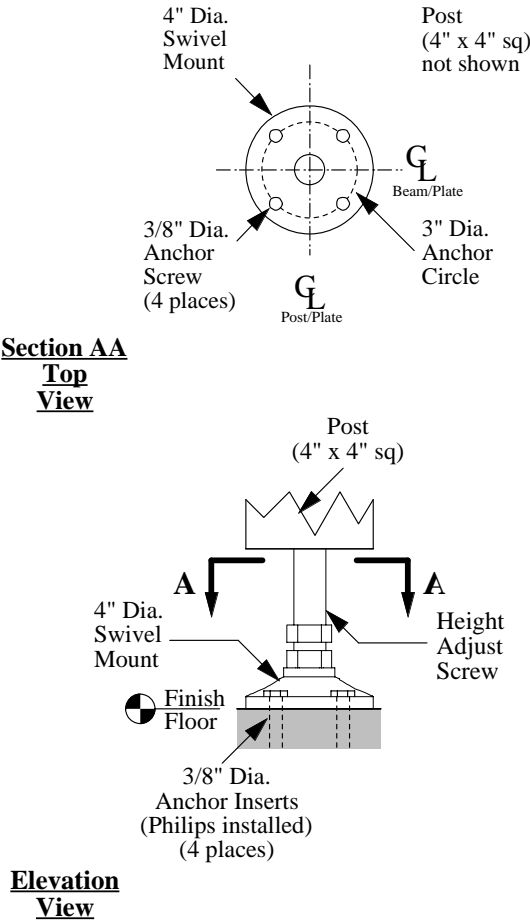
Figure 3-3. Skylight Anchor Plan, Y-Extension (short axis)

Note:
Although the non-seismic and seismic posts are different, the anchor hole patterns are identical.



Scale: 1" = 6"

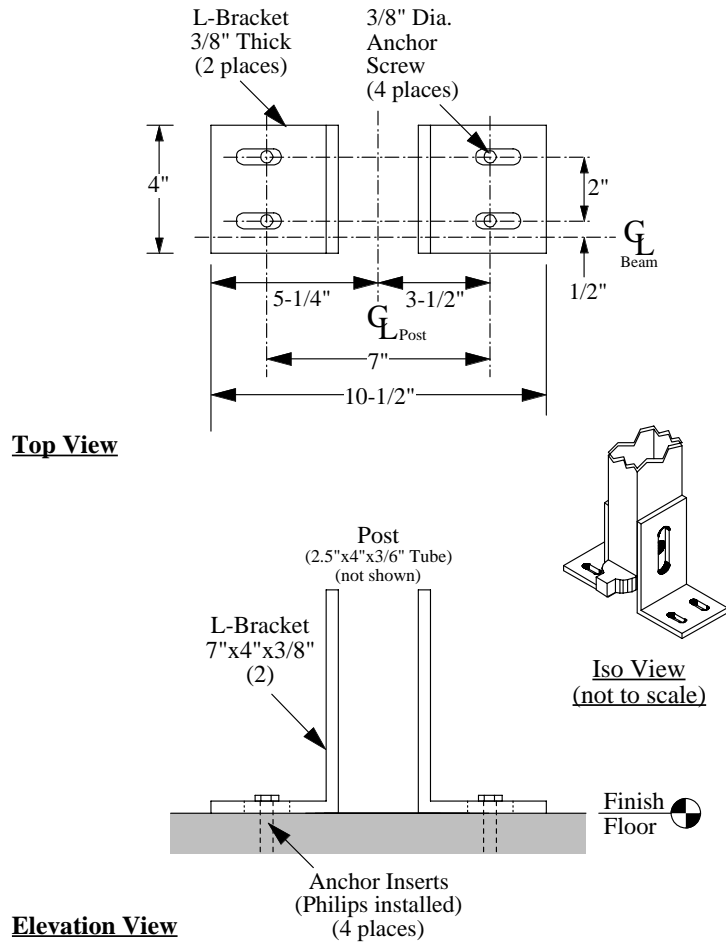
Figure 3-4. Mounting Assembly for Frame Support Post (non-Seismic and Seismic)



Note:
Installers determine the exact anchor locations so the Post will be vertical.

Scale: 1" = 6"

Figure 3-5. Mounting Assembly for Two-Drawer Collimator Exchanger Post



Note:
Installers suspend the Optional Collimator Exchanger Post from the Skylight Frame. Because the screws attaching the Post to the L-Brackets are in slotted holes, there is no significant vertical load on the floor. Installers determine the exact anchor locations so the Post will be vertical.

Scale: 1" = 6"

Figure 3-6. Mounting L-Brackets for Optional Collimator Exchanger Post

Section 4

Networking

Networking Situations

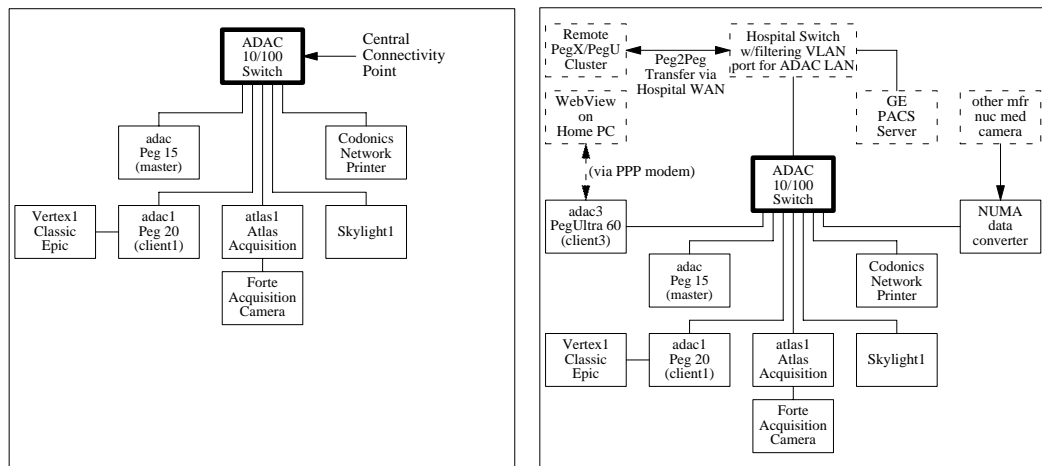
There are two general types of Skylight networking situations:

1. Single Camera/Computer. In a single camera/computer installation, the Skylight camera, the PegBlade computer, and, perhaps, a printer must be networked together. There is no need to connect to networking devices outside of the camera room.

The customer is responsible for providing one twin RJ-45 connection box near the PC tower and one near the PegBlade. The customer also needs to run Cat 5 cables in the walls, ceilings, or floors between the connection boxes. The upper half of Figure 4-1 illustrates this.

If the customer does not provide the connection boxes and does not run the Cat 5 cables in the walls, Philips will run those cables along the floor. That may be unsightly if the connection boxes are far apart.

2. Multiple Camera/Computer. In a multiple camera/computer installation, the Skylight camera, the PegBlade computer, and, perhaps, a printer may be networked to other networking devices. These other networking devices could be another Philips network, a hospital network, or other networking devices such as a network printer or a network viewing station as illustrated below.



In a multiple camera/computer situation, the customer must install the twin RJ-45 connector boxes near the PC tower and near the PegBlade. They must also run Cat 5 cables from the two connector boxes to a central connectivity point before Philips can network to other devices. The bottom half of Figure 4-1 illustrates this requirement.

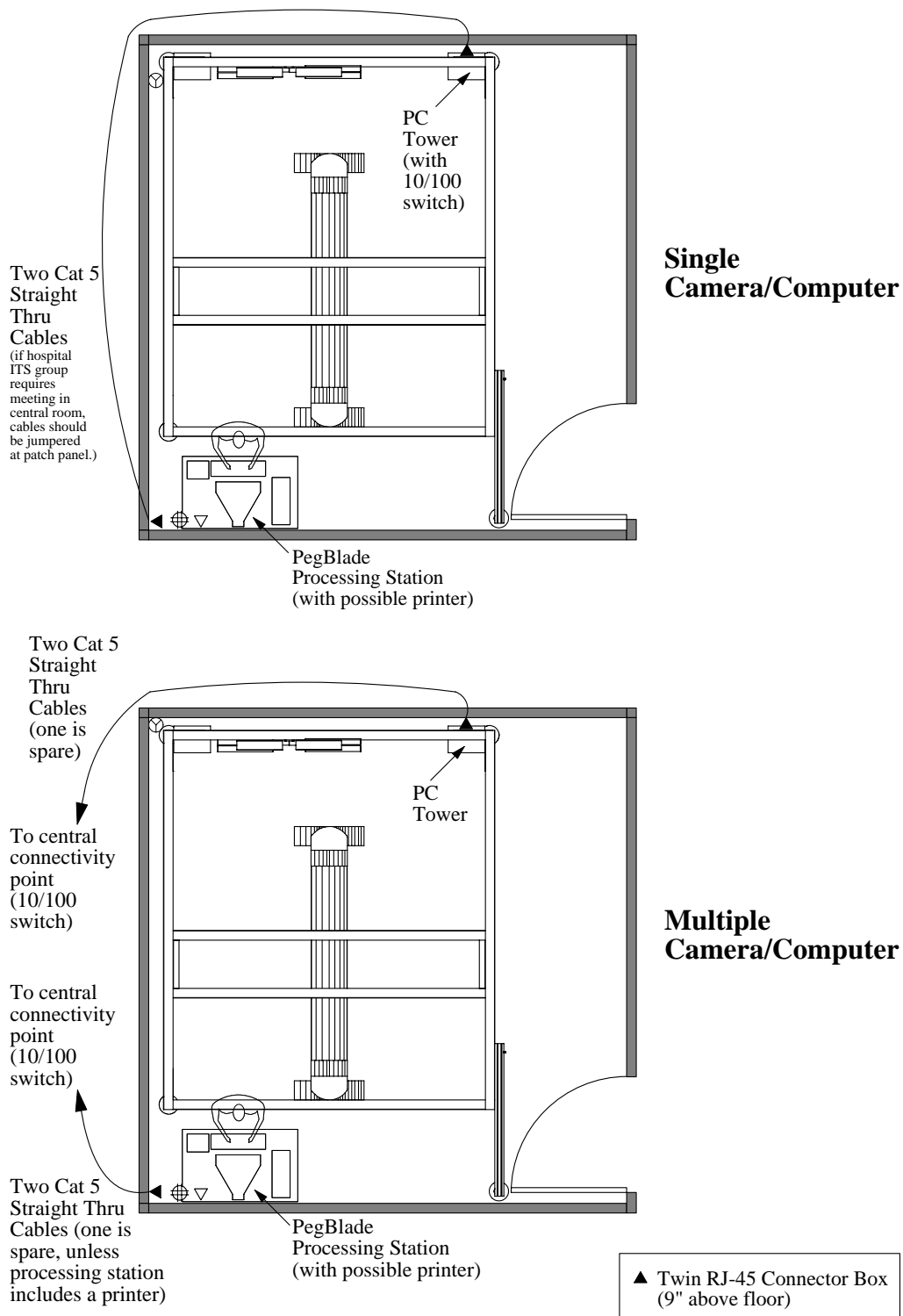


Figure 4-1. Single and Multiple Camera/Computer Networks.

Section 5

Shipping Information

Shipping Containers

The shipping crate and pallet sizes for Skylight components appear below.

<u>Component</u>	<u>W</u>	<u>x</u>	<u>D</u>	<u>x</u>	<u>H</u>	<u>Weights</u>		<u>Quantity</u>
						<u>Normal</u>	<u>Seismic</u>	
Detectors:	61"	x	40"	x	70"	1,600 lbs	1,600 lbs	2
	155	x	102	x	178 cm	726 kg	726 kg	
Posts:	100"	x	44"	x	12"	700 lbs	1,100 lbs	1
(all 4 pieces)	254	x	112	x	30 cm	318 kg	499 kg	
Exchanger:	101"	x	37"	x	12"	700 lbs	700 lbs	1
	257	x	94	x	30 cm	318 kg	318 kg	
Carriage:	137"	x	43"	x	14"	600 lbs	600 lbs	1
	348	x	109	x	36 cm	272 kg	272 kg	
Frame:	163"	x	27"	x	12"	1,000 lbs	1,000 lbs	1
(all 4 pieces)	414	x	69	x	30 cm	454 kg	454 kg	
Table:	120"	x	37"	x	30"	400 lbs	400 lbs	1
	305	x	94	x	76 cm	181 kg	181 kg	
Towers:	78"	x	41"	x	26"	400 lbs	400 lbs	1
	198	x	104	x	66 cm	181 kg	181 kg	
Covers:	78"	x	41"	x	26"	300 lbs	300 lbs	1
	198	x	104	x	66 cm	136 kg	136 kg	

Installers can remove the two largest components (Carriage and Frame) from their shipping crates to facilitate moving those components within a hospital. Carriage and Frame dimensions without shipping crates appear on the next page.

Largest Components without Shipping Containers

The Carriage and Frame sizes (without shipping crates) appear below:

<u>Component</u>	<u>W</u>	<u>x</u>	<u>D</u>	<u>x</u>	<u>H</u>	<u>Weights</u>		<u>Quantity</u>
						<u>Normal</u>	<u>Seismic</u>	
Carriage:	130"	x	39"	x	8"	495 lbs	495 lbs	1
	330	x	99	x	20 cm	225 kg	225 kg	
Frame:	158"	x	8"	x	4"	173 lbs	173 lbs	4
(1 of 4 pieces)	401	x	20	x	10 cm	78 kg	78 kg	

Although it takes several hours, installers can disassemble the Carriage into components no larger than about 130" x 4" x 8", and reassemble the Carriage in the camera room.

Section 6

Floor Loading

General Floor Loading Information

Unless the floor is a reinforced concrete slab poured on grade, a customer's licensed structural engineer *must* evaluate floor loading capacity using the data in this section.

The weight of the Skylight frame, carriage, detectors and collimators rests on the floor support posts and the two-drawer collimator exchanger post (see Section 3).

This section describes the floor loads in a minimum sized room (see Section 2), and within the frame (footprint) of the Skylight. It also describes the point loads.

Floor loads and point loads depend on the type and quantity of collimators a customer purchases. This section contains calculations for a (1) minimum set, (2) a typical set, and (3) a worst case set of collimators.

When collimator pairs are not on the detectors, operators will store collimator pairs in one of two types of collimator exchangers:

- a two-drawer collimator exchanger (holds up to four pairs of collimators), and
- a one-drawer collimator exchanger (holds up to two pairs of collimators).

The one-drawer collimator exchanger is optional. Customers will purchase that option only if they purchase more than four collimator pairs (which is uncommon).

Below is a list of collimator types and weights:

LEGP	= 110 lbs	MEGP	= 218 lbs
LEHR	= 114 lbs	HEGP	= 235 lbs
VXGP	= 110 lbs	HEHR	= 240 lbs (infrequently sold)
VXHR	= 119 lbs	Pinhole	= 260 lbs
VXUR	= 126 lbs		

Collimators come in pairs, except the Pinhole which comes as a single collimator.

Seismic Information

Section 3 describes anchorage and state of California seismic approval information.

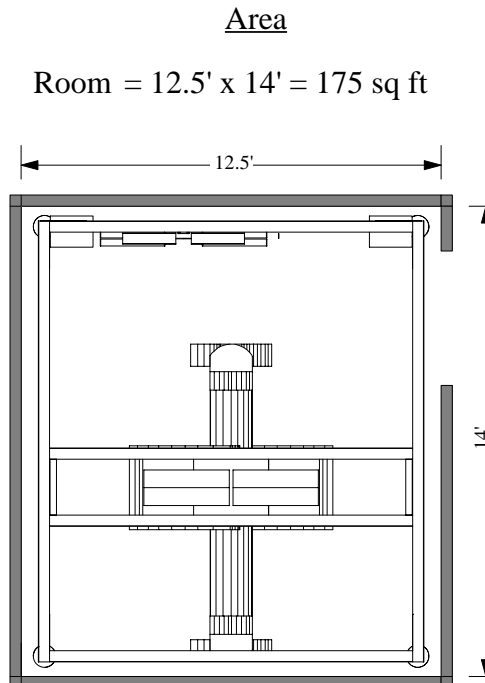
Seismic and non-seismic Skylight frames have different weights. Both weights are shown in this section. This document, however, does not describe seismic force reactions; Philips site-specific and pre-approval documents describe those reactions.

Both the seismic and non-seismic Skylight frames come in 8 ft. and 9 ft. heights. However, the weight difference between 8 ft. and 9 ft. Skylights is not significant. This section shows only 9 ft. weights for seismic and non-seismic frames.

“Room” Floor Loading

The calculations below assume a minimum sized room with two technologists, a patient and a room containing only Philips equipment.

<u>1. Minimum Set of Collimators</u>			
<u>Components</u>	<u>Non-seismic Wt (lbs)</u>	<u>Seismic Wt (lbs)</u>	
Skylight Frame & Detectors	4,212	5,023	
UPS Batteries	160	160	
PC Tower	112	112	
Power Tower	220	220	
Exchanger w/2 Drawers	552	552	
Collimators on Detectors: VXGP (2 x 110)	220	220	
Collimators on 2 Drwr Exch: None	0	0	
Patient Table	320	320	
Patient	400	400	
Technologists (2 x 200)	<u>400</u>	<u>400</u>	
Total	6,596	7,407	
Room Floor Load	= 6,596 ÷ 175	7,407 ÷ 175	
	= 38 lbs/ft²	42 lbs/ft²	



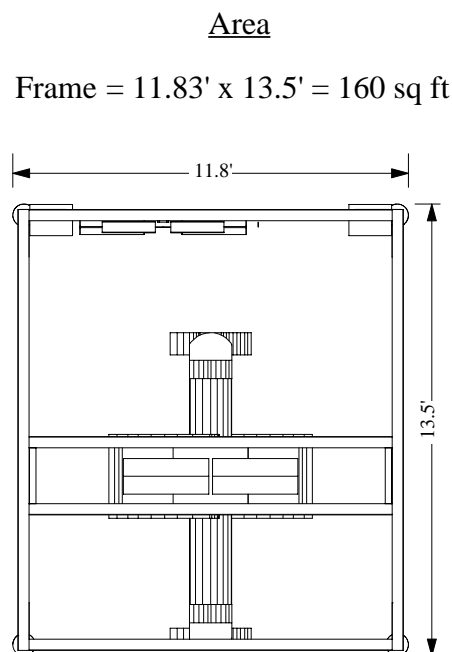
<u>2. Typical Set of Collimators</u>			
<u>Components</u>	<u>Non-seismic Wt (lbs)</u>	<u>Seismic Wt (lbs)</u>	
Skylight Frame & Detectors	4,212	5,023	
UPS Batteries	160	160	
PC Tower	112	112	
Power Tower	220	220	
Exchanger w/2 Drawers	552	552	
Collimators on Detectors: VXGP (2 x 110)	220	220	
Collimators on 2 Drwr Exch: MEGP (2 x 218)	436	436	
HEGP (2 x 235)	470	470	
LEGP (2 x 110)	220	220	
Patient Table	320	320	
Patient	400	400	
Technologists (2 x 200)	<u>400</u>	<u>400</u>	
Total	7,722	8,533	
Room Floor Load	= 7,722 ÷ 175	8,533 ÷ 175	
	= 44 lbs/ft²	49 lbs/ft²	

<u>3. Worst Case Set of Collimators</u>			
<u>Components</u>	<u>Non-seismic Wt (lbs)</u>	<u>Seismic Wt (lbs)</u>	
Skylight Frame & Detectors	4,212	5,023	
UPS Batteries	160	160	
PC Tower	112	112	
Power Tower	220	220	
Exchanger w/2 Drawers	552	552	
Collimators on Detectors: VXGP (2 x 110)	220	220	
Collimators on 2 Drwr Exch: MEGP (2 x 218)	436	436	
HEGP (2 x 235)	470	470	
Pinhole	260	260	
Exchanger w/1 drawer	281	281	
Collimators on 1 Drwr Exch: LEGP (2 x 110)	220	220	
LEHR (2 x 114)	228	228	
Patient Table	320	320	
Patient	400	400	
Technologists (2 x 200)	<u>400</u>	<u>400</u>	
Total	8,491	9,302	
Room Floor Load	= 8,491 ÷ 175	9,302 ÷ 175	
	= 49 lbs/ft²	53 lbs/ft²	

“Frame” Floor Loading

The calculations below examine only the floor loads of the Philips equipment within the area bounded by the Skylight frame (footprint).

1. Minimum Set of Collimators		
<u>Components</u>	<u>Non-seismic Wt (lbs)</u>	<u>Seismic Wt (lbs)</u>
Skylight Frame & Detectors	4,212	5,023
UPS Batteries	160	160
PC Tower	112	112
Power Tower	220	220
Exchanger w/2 Drawers	552	552
Collimators on Detectors: VXGP (2 x 110)	220	220
Collimators on 2 Drwr Exch: None	0	0
Patient Table	<u>320</u>	<u>320</u>
Total	5,796	6,607
Room Floor Load	= 5,796 ÷ 160	6,607 ÷ 160
	= 36 lbs/ft²	41 lbs/ft²



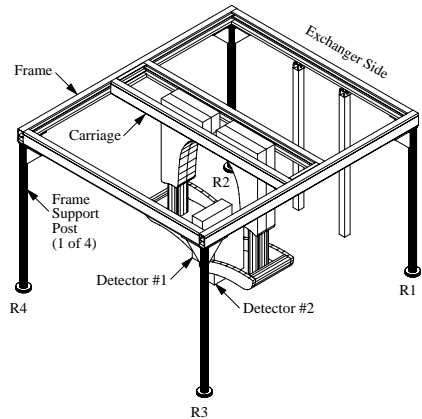
2. Typical Set of Collimators		
<u>Components</u>	<u>Non-seismic Wt (lbs)</u>	<u>Seismic Wt (lbs)</u>
Skylight Frame & Detectors	4,212	5,023
UPS Batteries	160	160
PC Tower	112	112
Power Tower	220	220
Exchanger w/2 Drawers	552	552
Collimators on Detectors: VXGP (2 x 110)	220	220
Collimators on 2 Drwr Exch: MEGP (2 x 218)	436	436
HEGP (2 x 235)	470	470
LEGP (2 x 110)	220	220
Patient Table	<u>320</u>	<u>320</u>
Total	6,922	7,733
Room Floor Load	= 6,922 ÷ 160	7,733 ÷ 160
	= 43 lbs/ft²	48 lbs/ft²

3. Worst Case Set of Collimators		
<u>Components</u>	<u>Non-seismic Wt (lbs)</u>	<u>Seismic Wt (lbs)</u>
Skylight Frame & Detectors	4,212	5,023
UPS Batteries	160	160
PC Tower	112	112
Power Tower	220	220
Exchanger w/2 Drawers	552	552
Collimators on Detectors: VXGP (2 x 110)	220	220
Collimators on 2 Drwr Exch: MEGP (2 x 218)	436	436
HEGP (2 x 235)	470	470
Pinhole	260	260
Exchanger w/1 drawer	281	281
Collimators on 1 Drwr Exch: LEGP (2 x 110)	220	220
LEHR (2 x 114)	228	228
Patient Table	<u>320</u>	<u>320</u>
Total	7,691	8,502
Room Floor Load	= 7,691 ÷ 160	8,502 ÷ 160
	= 48 lbs/ft²	53 lbs/ft²

Carriage, Frame and Detector Weights

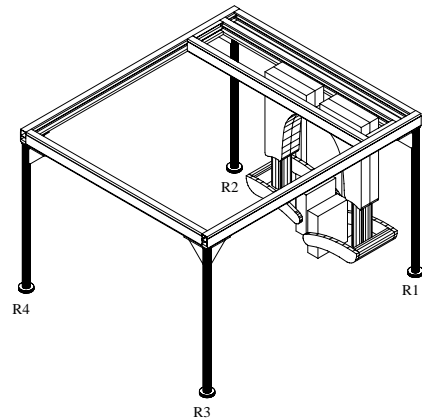
The illustrations below show five different cases of extreme carriage and detector positions which affect the point loads that appear later in this section.

1. Carriage in

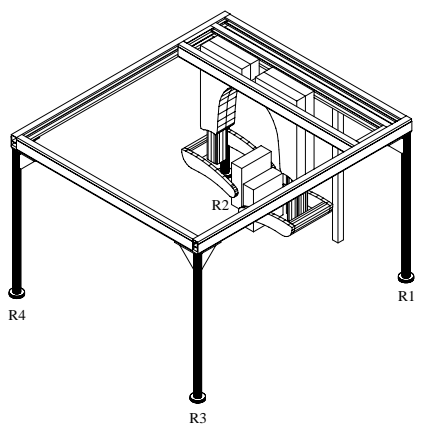


Object	Weights	
	Weight (lbs) Non-Seismic	Weight (lbs) Seismic
Frame, Posts, Batteries	1,377	2,188
Carriage	495	495
Detectors (both) (w/o collimators)	2,500	2,500

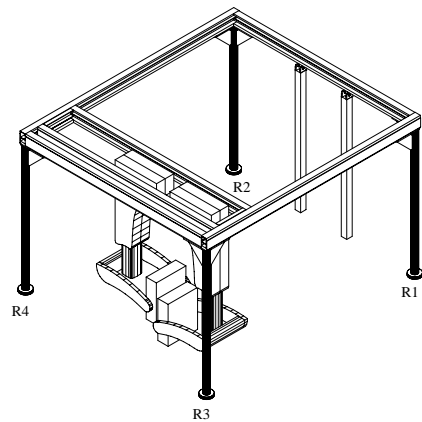
2. Carriage Near Exchanger, Detectors Near R1



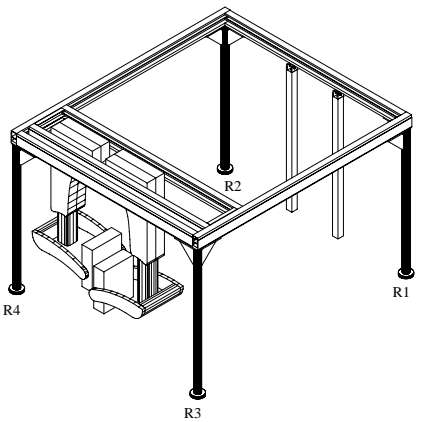
3. Carriage Near Exchanger, Detectors Near R2



4. Carriage Opposite Exchanger, Detectors Near R3



5. Carriage Opposite Exchanger, Detectors Near R4

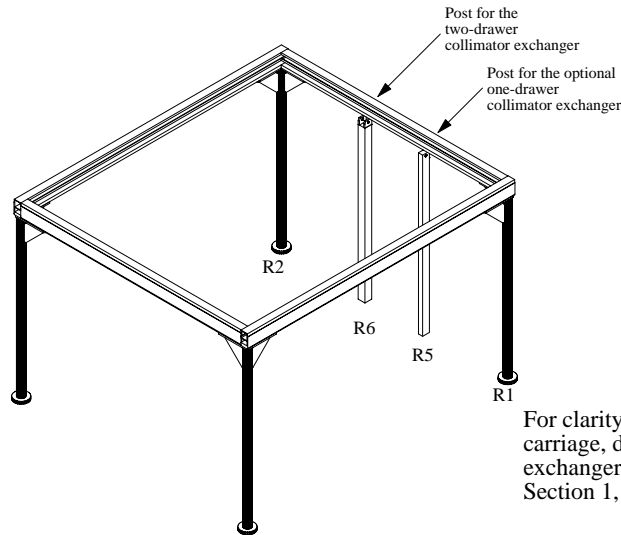


Collimator Exchanger Weights

The loads on each collimator exchanger post are a function of the number and type of collimators that a customer purchases.

The load on the two-drawer collimator exchanger appears on R6.

The optional one-drawer collimator exchanger post (R5) hangs from the Skylight frame; 2/3 of its weight affects the load on R1 and 1/3 of its weight affects the load on R2.



Minimum Weights on Two-Drawer Collimator Exchanger

Post	Exchanger (lbs)	Collimators	Load Calculation on R6 (lbs)
R6	552	VGXP (2)	$552+220 = 772$

Typical Weights on Two-Drawer Collimator Exchanger

Post	Exchanger (lbs)	Collimators	Load Calculation on R6 (lbs)
R6	552	VGXP (2), MEGP (2), HEGP (2), LEGP (2)	$552+220+436+470+220=1,898$

Worst Case Weights on both Collimator Exchangers

Post	Exchanger (lbs)	Typical Collimators	Load Calculation (lbs)	Load (lbs)		
				R6	R1	R2
R6 (two drawer)	552	VGXP (2), MEGP (2), HEGP (2), Pinhole (1)	$552+220+436+470+260=1,938$	1,938		
R5 (one drawer) (optional)	281	LEGP (2), LEHR (2)	$281+220+228=729$		457 (2/3 R5)	272 (1/3 R5)

Point Loading with Minimum Collimators

The numbers below and the next page illustrate the total loads on all four frame support posts (R1, R2, R3 & R4) and the two-drawer collimator exchanger post (R6) assuming the customer only purchases one pair of VXGP collimators.

The point loads change as the VXGP collimator pairs move from the detectors to the two-drawer collimator exchanger.

<u>Non-seismic Skylight</u>									
<u>Case</u>	<u>Carriage Position</u>	<u>Detectors Position</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>				
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>	<u>R6</u>
1a	In Center	In center	VXGP	none	1,188	1,188	1,108	1,108	552
1b	In Center	In center	none	VXGP	1,133	1,133	1,053	1,053	772
2a	Near Exchanger	Near R1	VXGP	none	2,135	1,347	627	482	552
2b	Near Exchanger	Near R1	none	VXGP	2,010	1,286	604	470	772
3a	Near Exchanger	Near R2	VXGP	none	1,347	2,135	482	627	552
3b	Near Exchanger	Near R2	none	VXGP	1,286	2,010	470	604	772
4a	Opposite Exchanger	Near R3	VXGP	none	707	562	2,055	1,267	552
4b	Opposite Exchanger	Near R3	none	VXGP	684	550	1,930	1,206	772
5a	Opposite Exchanger	Near R4	VXGP	none	562	707	1,267	2,055	552
5b	Opposite Exchanger	Near R4	none	VXGP	550	684	1,206	1,930	772

The largest point load in the above situation is 2,135 lbs.

Seismic Skylight									
<u>Case</u>	<u>Carriage Position</u>	<u>Detectors Position</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>				
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>	<u>R6</u>
1a	In Center	In center	VXGP	none	1,391	1,391	1,311	1,311	552
1b	In Center	In center	none	VXGP	1,336	1,336	1,256	1,256	772
2a	Near Exchanger	Near R1	VXGP	none	2,338	1,550	830	685	552
2b	Near Exchanger	Near R1	none	VXGP	2,213	1,489	807	673	772
3a	Near Exchanger	Near R2	VXGP	none	1,550	2,338	685	830	552
3b	Near Exchanger	Near R2	none	VXGP	1,489	2,213	673	807	772
4a	Opposite Exchanger	Near R3	VXGP	none	910	765	2,258	1,470	552
4b	Opposite Exchanger	Near R3	none	VXGP	887	753	2,133	1,409	772
5a	Opposite Exchanger	Near R4	VXGP	none	765	910	1,470	2,258	552
5b	Opposite Exchanger	Near R4	none	VXGP	753	887	1,409	2,133	772

The largest point load in the above situation is 2,338 lbs.

Point Loading with Typical Collimators

The numbers below and the next page illustrate the total loads on all four frame support posts and the two-drawer collimator exchanger post (R6) assuming the customer purchases pairs of VXGP, MEGP, HEGP and LEGP collimators.

The point loads change as the HEGP collimator pairs move from the detectors to the two-drawer collimator exchanger.

<u>Non-seismic Skylight</u>									
<u>Case</u>	<u>Carriage Position</u>	<u>Detector Positions</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>				
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>	<u>R6</u>
1a	In Center	In center	HEGP	MEGP, VXGP, LEGP	1,250	1,250	1,170	1,170	1,428
1b	In Center	In center	none	VXGP,MEGP HEGP, LEGP	1,133	1,133	1,053	1,053	1,898
2a	Near Exchanger	Near R1	HEGP	MEGP, VXGP, LEGP	2,277	1,416	653	495	1,428
2b	Near Exchanger	Near R1	none	VXGP,MEGP HEGP, LEGP	2,010	1,286	604	470	1,898
3a	Near Exchanger	Near R2	HEGP	MEGP, VXGP, LEGP	1,416	2,277	495	653	1,428
3b	Near Exchanger	Near R2	none	VXGP,MEGP HEGP, LEGP	1,286	2,010	470	604	1,898
4a	Opposite Exchanger	Near R3	HEGP	MEGP, VXGP, LEGP	733	575	2,197	1,336	1,428
4b	Opposite Exchanger	Near R3	none	VXGP,MEGP HEGP, LEGP	684	550	1,930	1,206	1,898
5a	Opposite Exchanger	Near R4	HEGP	MEGP, VXGP, LEGP	575	733	1,336	2,197	1,428
5b	Opposite Exchanger	Near R4	none	VXGP,MEGP HEGP, LEGP	550	684	1,206	1,930	1,898

The largest point load in the above situation is 2,277 lbs.

Seismic Skylight									
<u>Case</u>	<u>Carriage Position</u>	<u>Detector Positions</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>				
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>	<u>R6</u>
1a	In Center	In center	HEGP	MEGP, VXGP, LEGP	1,453	1,453	1,373	1,373	1,428
1b	In Center	In center	none	VXGP,MEGP HEGP, LEGP	1,336	1,336	1,256	1,256	1,898
2a	Near Exchanger	Near R1	HEGP	MEGP, VXGP, LEGP	2,480	1,619	856	698	1,428
2b	Near Exchanger	Near R1	none	VXGP,MEGP HEGP, LEGP	2,213	1,489	807	673	1,898
3a	Near Exchanger	Near R2	HEGP	MEGP, VXGP, LEGP	1,619	2,480	698	856	1,428
3b	Near Exchanger	Near R2	none	VXGP,MEGP HEGP, LEGP	1,489	2,213	673	807	1,898
4a	Opposite Exchanger	Near R3	HEGP	MEGP, VXGP, LEGP	936	778	2,400	1,539	1,428
4b	Opposite Exchanger	Near R3	none	VXGP,MEGP HEGP, LEGP	887	753	2,133	1,409	1,898
5a	Opposite Exchanger	Near R4	HEGP	MEGP, VXGP, LEGP	778	936	1,539	2,400	1,428
5b	Opposite Exchanger	Near R4	none	VXGP,MEGP HEGP, LEGP	753	887	1,409	2,133	1,898

The largest point load in the above situation is 2,480 lbs.

Point Loading with Worst Case Collimators (uncommon)

The numbers below and the next page illustrate the total loads on all four frame support posts and the two-drawer collimator exchanger post (R6) assuming a pin hole collimator and pairs of LEHR, VXGP, MEGP, HEGP and LEGP collimators.

The LEHR and LEGP collimators will be on the optional one-drawer collimator exchanger post; that post hangs from the frame, exerts no significant load on its post, but adds load to posts R1 and R2. The other collimators put loads on R6.

<u>Non-seismic Skylight</u>									
<u>Case</u>	<u>Carriage Position</u>	<u>Detector Positions</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>				
			<u>Detectors</u>	<u>Exchangers</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>	<u>R6</u>
1a	In Center	In center	HEGP	MEGP, VXGP, Pinhole LEGP, LEHR	1,736	1,493	1,170	1,170	1,468
1b	In Center	In center	none	VXGP, MEGP HEGP, Pinhole LEGP, LEHR	1,619	1,376	1,053	1,053	1,938
2a	Near Exchanger	Near R1	HEGP	MEGP, VXGP, Pinhole LEGP, LEHR	2,763	1,659	653	495	1,468
2b	Near Exchanger	Near R1	none	VXGP, MEGP HEGP, Pinhole LEGP, LEHR	2,496	1,529	604	470	1,938
3a	Near Exchanger	Near R2	HEGP	MEGP, VXGP, Pinhole LEGP, LEHR	1,902	2,520	495	653	1,468
3b	Near Exchanger	Near R2	none	VXGP, MEGP HEGP, Pinhole LEGP, LEHR	1,772	2,253	470	604	1,938
4a	Opposite Exchanger	Near R3	HEGP	MEGP, VXGP, Pinhole LEGP, LEHR	1,219	818	2,197	1,336	1,468
4b	Opposite Exchanger	Near R3	none	VXGP, MEGP HEGP, Pinhole LEGP, LEHR	1,170	793	1,930	1,206	1,938
5a	Opposite Exchanger	Near R4	HEGP	MEGP, VXGP, Pinhole LEGP, LEHR	1,061	976	1,336	2,197	1,468
5b	Opposite Exchanger	Near R4	none	VXGP, MEGP HEGP, Pinhole LEGP, LEHR	1,036	927	1,206	1,930	1,938

The largest point load in the above situation is 2,763 lbs.

Seismic Skylight									
Case	Carriage Position	Detector Positions	Collimators on		Point Loads (lbs)				
			Detectors	Exchanger	R1	R2	R3	R4	R6
1a	In Center	In center	HEGP	MEGP, VXGP, Pinhole LEGP,LEHR	1,939	1,696	1,373	1,373	1,468
1b	In Center	In center	none	VXGP,MEGP HEGP,Pinhole LEGP,LEHR	1,822	1,579	1,256	1,256	1,938
2a	Near Exchanger	Near R1	HEGP	MEGP, VXGP,Pinhole LEGP,LEHR	2,966	1,862	856	698	1,468
2b	Near Exchanger	Near R1	none	VXGP,MEGP HEGP, Pinhole LEGP,LEHR	2,699	1,732	807	673	1,938
3a	Near Exchanger	Near R2	HEGP	MEGP, VXGP,Pinhole LEGP,LEHR	2,105	2,723	698	856	1,468
3b	Near Exchanger	Near R2	none	VXGP,MEGP HEGP,Pinhole LEGP,LEHR	1,975	2,456	673	807	1,938
4a	Opposite Exchanger	Near R3	HEGP	MEGP, VXGP,Pinhole LEGP,LEHR	1,422	1,021	2,400	1,539	1,468
4b	Opposite Exchanger	Near R3	none	VXGP,MEGP HEGP,Pinhole LEGP,LEHR	1,373	996	2,133	1,409	1,938
5a	Opposite Exchanger	Near R4	HEGP	MEGP, VXGP,Pinhole LEGP,LEHR	1,264	1,179	1,539	2,400	1,468
5b	Opposite Exchanger	Near R4	none	VXGP,MEGP HEGP,Pinhole LEGP,LEHR	1,239	1,130	1,409	2,133	1,938

The largest point load in the above situation is 2,966 lbs.

Point Load Correlation with Site-specific/Pre-approval OSHPD

Site-specific/Pre-approval seismic calculations for California OSHPD include different point load assumptions than the previous calculations in the section.

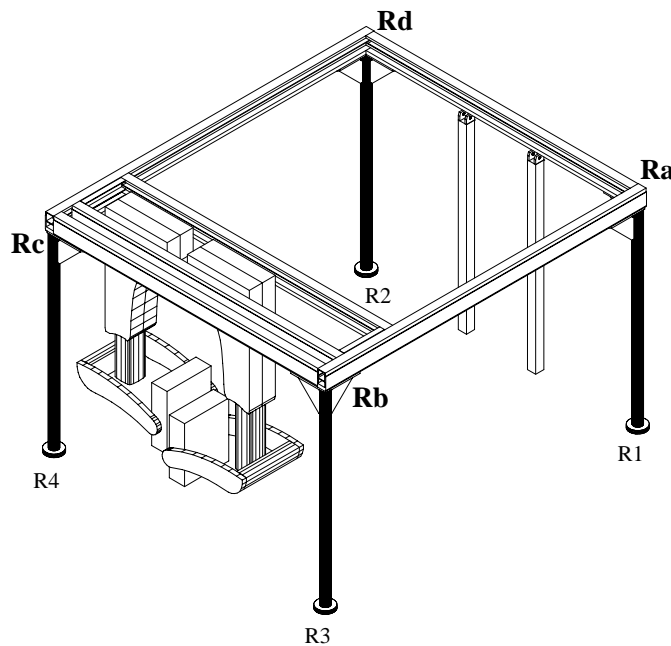
OSHPD seismic calculations assume the Skylight frame is a structure upon which our carriage, arms, detectors and collimators hang.

For OSHPD the loads are at the corners of the *suspended* frame (Ra, Rb, Rc and Rd) and *not* at the floor level (R1, R2, R3 and R4). See below figure. Thus, OSHPD calculations include the weights of the carriage, arms, detectors and collimators, but *exclude* the weights of the frame and frame support posts.

The calculations in the rest of this section:

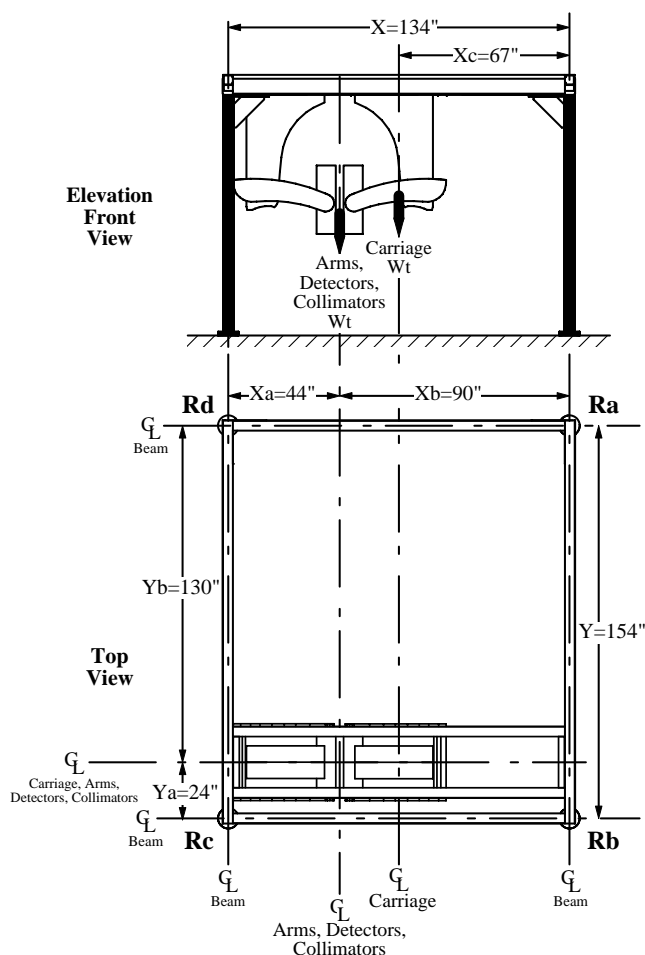
- start with the “Dead Load Wp Effects on ABDC” on pages 71 and 166 of Philips OSHPD documents,
- then calculate floor point loads that include the weight of the frame and frame support posts, and
- finally calculate floor point loads that include the weights of the two-drawer collimator exchanger.

The example calculations in the rest of this section show the carriage opposite the exchanger and the detectors near Rc (R4).



The elevation and top views on the right show the locations of the center lines of the:

- carriage
- combination of both detector assemblies (including the both arms, both detectors and both collimators)
- beams.



The equations for calculating the effect of the moving loads on all frame corners are:

$$\begin{aligned}
 R1 = Ra &= Wd * (Xa/X) * (Ya/Y) & + & Wc * (Xc/X) * (Ya/Y) \\
 R2 = Rd &= Wd * (Xb/X) * (Ya/Y) & + & Wc * (Xc/X) * (Ya/Y) \\
 R3 = Rb &= Wd * (Xa/X) * (Yb/Y) & + & Wc * (Xc/X) * (Yb/Y) \\
 R4 = Rc &= Wd * (Xb/X) * (Yb/Y) & + & Wc * (Xc/X) * (Yb/Y)
 \end{aligned}$$

where the values for different carriage/detector positions (as illustrate above) are:

	$\frac{Xc}{X}$	$\frac{Xa}{X}$	$\frac{Xb}{X}$	$\frac{X}{X}$	$\frac{Ya}{Y}$	$\frac{Yb}{Y}$	$\frac{Y}{Y}$
Case 1 Center	67	67	67	134	77	77	154
Case 2 Near R1/Ra	67	90	44	134	130	24	154
Case 3 Near R2/Rd	67	44	90	134	130	24	154
Case 4 Near R3/Rb	67	90	44	134	24	130	154
Case 5 Near R4/Rc	67	44	90	134	24	130	154

and where the weights of the *seismic* Skylight with HEGP collimators on the detectors are:

$$\begin{aligned}
 Wd &= W_{\text{detectors/arms}} + W_{\text{collimators}} = 2,500 + (2 \times 235) = 2,970 \text{ lbs} \\
 Wc &= W_{\text{carriage}} = 495 \text{ lbs} \\
 Wf &= W_{\text{frame/posts}} = 2,028 \text{ lbs} \\
 Wb &= W_{\text{batteries}} = 160 \text{ lbs}
 \end{aligned}$$

The equations for calculating the fixed loads are:

$$\begin{aligned}
 R1 = R2 &= 2,028/4 \\
 R3 = R4 &= 2,028/4 + 160/2
 \end{aligned}$$

Below are the loads on the corners of the *suspended frame* due to the carriage, arms, detectors and HEGP collimators when those components are near Rc. These numbers (the moving loads) are the same as the numbers on pages 71 and 166 of the Philips OSHPD documents. These numbers *exclude* frame, frame support posts and UPS batteries. The total weight is 3,465 lbs (495 + 2,500 + 2x235).

Seismic Skylight Loads (Moving Only) on Suspended Frame								
<u>Case</u>	<u>Carriage Position</u>	<u>Detectors Position</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>			
			<u>Detectors</u>	<u>Exchanger</u>	<u>Ra</u>	<u>Rd</u>	<u>Rb</u>	<u>Rc</u>
5	Opposite Exchanger	Near Rc	HEGP	none	191	349	1,032	1,893

Below are the loads on the *floor* due to just the fixed loads (frame, frame support posts and UPS batteries). The total weight is 2,188 lbs.

Seismic Skylight Loads (Fixed Only) on Floor								
<u>Case</u>	<u>Carriage Position</u>	<u>Detectors Position</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>			
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>
5	Opposite Exchanger	NA	NA	none	587	587	507	507

Below are the combined moving and fixed loads. The total weight is 5,653 lbs (3,465 + 2,188).

Seismic Skylight Loads (Fixed and Moving) on Floor								
<u>Case</u>	<u>Carriage Position</u>	<u>Detectors Position</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>			
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>
5	Opposite Exchanger	Near R4	HEGP	none	778	936	1,539	2,400

Below are the combined moving and fixed loads in all five carriage/detector positions plus typical collimator pairs (VXGP, MEGP & LEGP) in the two-drawer collimator exchanger. The total weight is 7,081 lbs (3,465 + 2,188 + 552 + 220 + 436 + 220). This excludes non frame components (PC Tower, Power Tower and Patient Table).

Seismic Skylight Loads (Fixed, Moving & Two-Drawer Exchanger) on Floor									
<u>Case</u>	<u>Carriage Position</u>	<u>Detectors Position</u>	<u>Collimators on</u>		<u>Point Loads (lbs)</u>				
			<u>Detectors</u>	<u>Exchanger</u>	<u>R1</u>	<u>R2</u>	<u>R3</u>	<u>R4</u>	<u>R6</u>
1	In center	In center	HEGP	VXGP,MEGP,LEGP	1,453	1,453	1,373	1,373	1,428
2	NearExchanger	Near R1	HEGP	VXGP,MEGP,LEGP	2,480	1,619	856	698	1,428
3	Near Exchanger	Near R2	HEGP	VXGP,MEGP,LEGP	1,619	2,480	698	856	1,428
4	Opposite Exchanger	Near R3	HEGP	VXGP,MEGP,LEGP	936	778	2,400	1,539	1,428
5	Opposite Exchanger	Near R4	HEGP	VXGP,MEGP,LEGP	778	936	1,539	2,400	1,428

The largest point load is 2,480 lbs.